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ABSTRACT

Award winning designs are presented demonstrating that economical dual-use shelter space can be incorporated in the designs of new buildings without sacrifice of either function or aesthetic values. The eight award winning designs are discussed, and graphic illustration is provided of the nature of dual-use shelter, which contributes to understanding of the techniques for controlling exposure to gamma radiation from fallout. (FS)

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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1966 Architectural Awards

Buildings with Fallout Shelter

A project of the Office of Civil Defense/Department of Defense conducted by The American Institute of Architects

TR-49 December 1967

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1966 Architectural Awards Buildings with Fallout Shelter

Preface

The 1966 Awards Program—Buildings with Fallout Shelter—was conducted by the American Institute of Architects for the Office of Civil Defense. The stated objective of the Awards Program was to "bring public recognition and honor to architects, engineers and owners responsible for the development of projects demonstrating architectural excellence and incorporating effective and economical dual-use shelter space."

This booklet, presenting eight distinguished buildings, is intended not only to bring additional honor to the architects, engineers and owners of the award winning projects, but to provide additional demonstration that economical dual-use shelter space can be incorporated in the designs of new buildings without sacrifice of either functional or aesthetic values.

The Jury was instructed to judge entries first on the quality of the total design, including planning, functional and aesthetic considerations, and then on the adequacy and validity of the design for dual-use shelter.

A study of these designs is recommended to members of the design professions and to owners of proposed new buildings.

A. Stanley McGaughan, FAIA
Professional Adviser
September 1967

Contents

Statement of the Department of Defense
page 4

Statement by
The American Institute of Architects
page 5

Members of the Jury
page 6

The Awards
page 7

Basic Terminology of Radiation Shielding
page 60

Basic Concepts of Radiation Shielding
page 61

The Awards Program
page 62

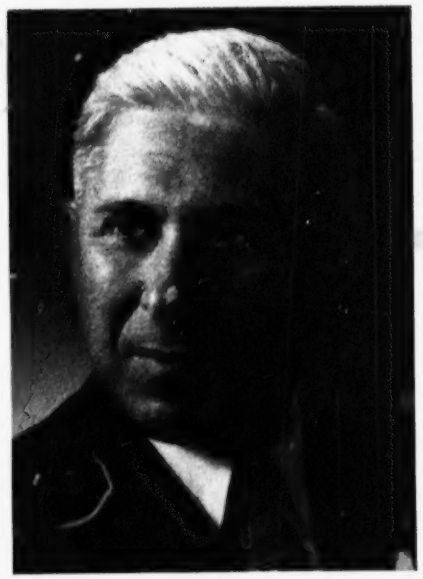
Statement of the Department of Defense

The National Shelter Program has progressed to the point where radiation protection features are included in the designs of new buildings with increased frequency. The examples set by many hundreds of owners and architects have encouraged others to consider low cost and no cost techniques for maximizing the shelter potential of their buildings by including shielding in the early design stage.

The first awards program to honor owners, architects, and consulting engineers who have produced outstanding architecture that includes dual-use shelter space was recently conducted for OCD by the American Institute of Architects. The designs shown in this booklet are excellent examples of ingenuity, imagination, and team effort which result in good architecture containing shelter without adversely affecting function, appearance, or cost. In fact, five of the eight buildings achieved radiation protection at no added cost.

In order to attain the national goal of shelter for all, advantage must be taken of the maximum shelter potential in new construction. Architects and consulting engineers, through the application of proved techniques for radiation protection, can attain this objective. The buildings honored here have achieved this in their designs and contribute to the defense of the country. They set the pace for all to follow.

Joseph Romm
Acting Director of Civil Defense



Mr. Romm

Statement of The American Institute of Architects

The American Institute of Architects continues its cooperation with the Office of Civil Defense and is delighted with the contributions of the design professions toward the advancement of the national civil defense program. An awards program for buildings with fallout shelter represents significant progress in itself. In recent years, the Institute has conducted for OCD three national design competitions investigating dual-use shelter in various types of buildings. Now we have moved forward from the hypothetical to the real and are recognizing the architects, engineers and owners of completed buildings which incorporate such dual-use shelter.

The eight projects—three of them First Honor Award winners and five of them winners of Awards of Merit—graphically displayed in this booklet all exhibit architectural excellence, and they all incorporate effective and economical dual-use shelter space. They testify to the practicality of the concept of wedding the need for fallout shelter with outstanding architecture.

As a member of the jury which selected the Award winners, I extend my personal congratulations to the winning designers and owners. As president of AIA, I am pleased to express the Institute's appreciation to OCD for its distinguished service to the public and the architectural profession in making this Awards Program possible.

Robert L. Durham, FAIA
President, The American Institute of Architects

Mr. Durham

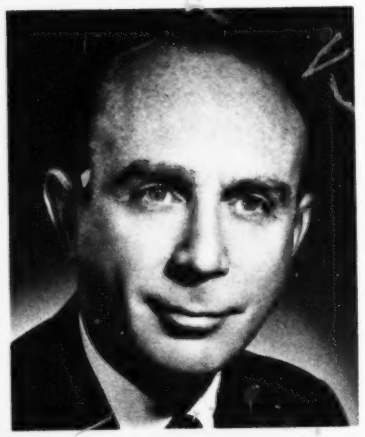
the Jury

James E. Roembke, P.E.
Deputy Assistant
Director of Civil
Defense for Technical
Services
Department of
Defense,
Washington, D.C.

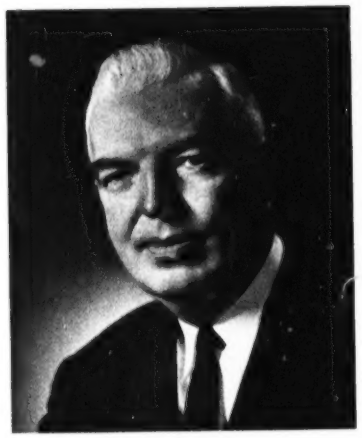
David H. Condon, FAIA
Keys, Lethbridge &
Condon, Architects
Washington, D. C.

Robert L.
Durham, FAIA
Durham, Anderson &
Freed, Architects
Seattle, Washington

Charles DeLeuw
De Leuw, Cather &
Company, Engineers
Chicago, Illinois



James W.
Elmore, FAIA
Dean, College of
Architecture
Arizona State
University
Tempe, Arizona



Professional Adviser
A. Stanley
McGaughan, FAIA
McGaughan &
Johnson, Architects
Washington, D. C.

Technical Adviser
Robert Berne, AIA
Chief Architect
Office of Civil Defense
Department of
Defense
Washington, D.C.

1966 Architectural Awards

First Honor Award

Dormitories for Central Washington State College
Ellensburg, Washington

Owner: Central Washington State College

Architect: Fred Bassetti & Company/Architects
Seattle, Washington

Engineer and Fallout Shelter Analyst:
Richard F. Janke, P.E., Seattle, Washington

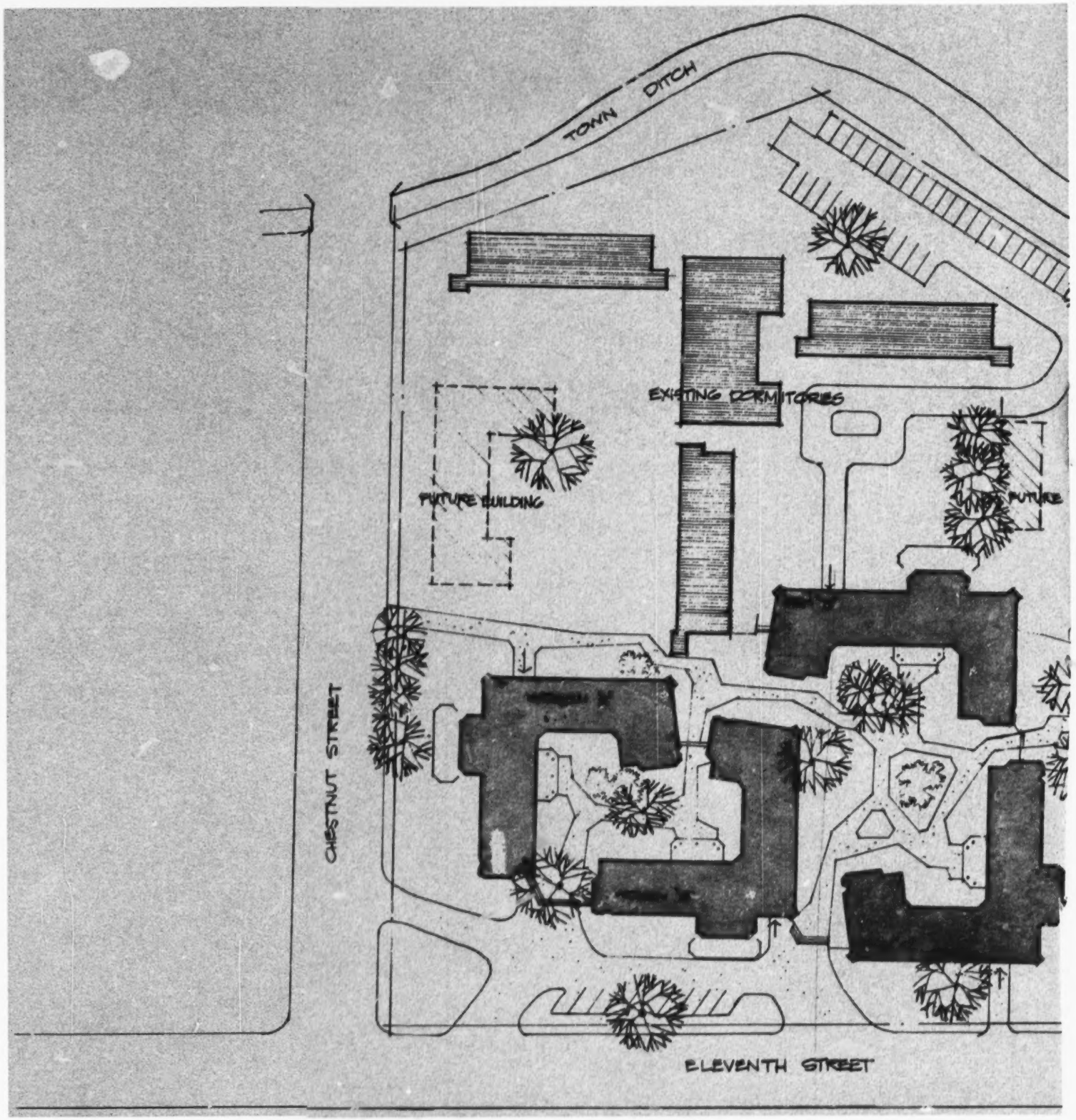
Jury Comment

Handsome exterior spaces are achieved by the ingenious arrangement of four identical buildings. The design of the standard building is intricate enough in shape and detail to create an exciting sequence of spaces and architectural interest. The controlled use of simple materials and consistent detailing gives cohesiveness to the whole design. Careful preservation of existing trees also contributes to the vitality of the exterior spaces.

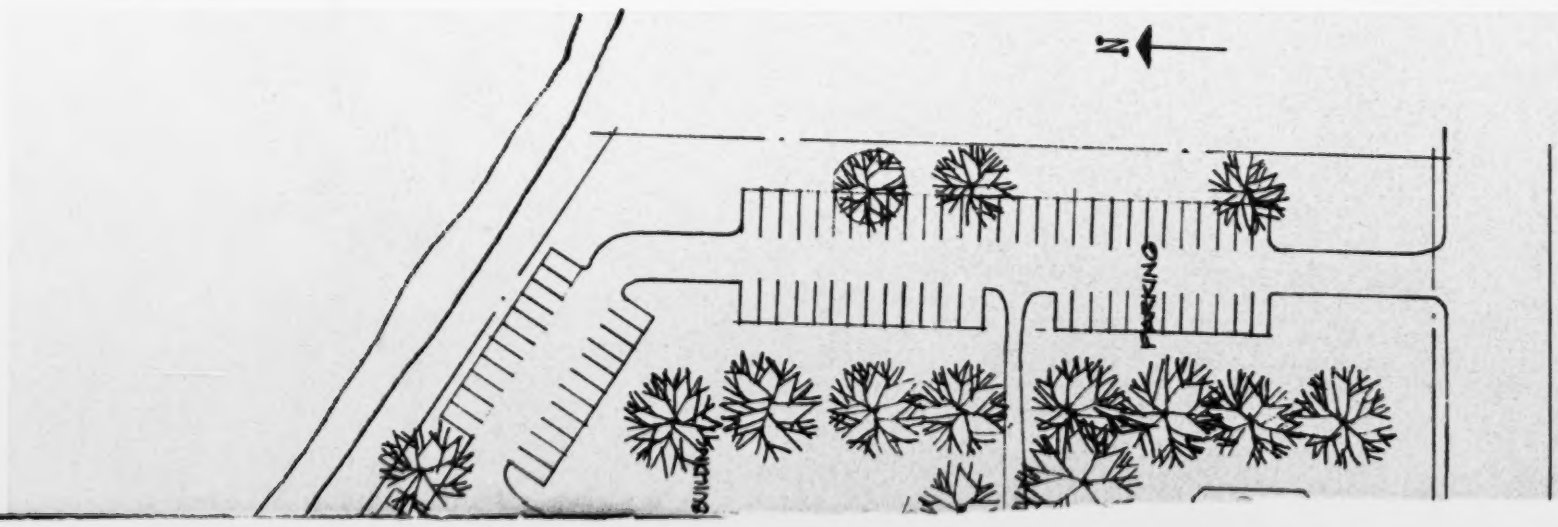
Architect's Statement

The college dormitory group was designed to house 500 students—250 men and 250 women. It comprises student rooms, mainly doubles, plus related facilities such as laundries, lounges, ironing areas and bath complexes. The site is flat and has clumps of native cottonwood and willow trees. Minimal parking is provided.

Design Solution: Individuality in living spaces was sought. We therefore designed a variety of living areas. No two of the spaces when placed next to each other on a simple double loaded corridor plan are the same. This variety in room types was achieved by allowing the rooms to take their shapes naturally, in the various parts of the building, rather than forcing them into a uniform mold. Rooms in outside corners differ from those in inside corners. Those next to stairs or toilets are modified by these influences. A natural variety results.



site plan


N
PARKING
BUILDING

Extremes of cold and heat dictated a masonry cavity wall with a minimum of large openings. Other load-bearing brick walls extended the maintenance-free design to a large percentage of the building.

The four buildings (two more were added later) are grouped to enlarge the living spaces into courts where students may meet and enliven their social and educational experiences.

Shelter Analyst's Remarks

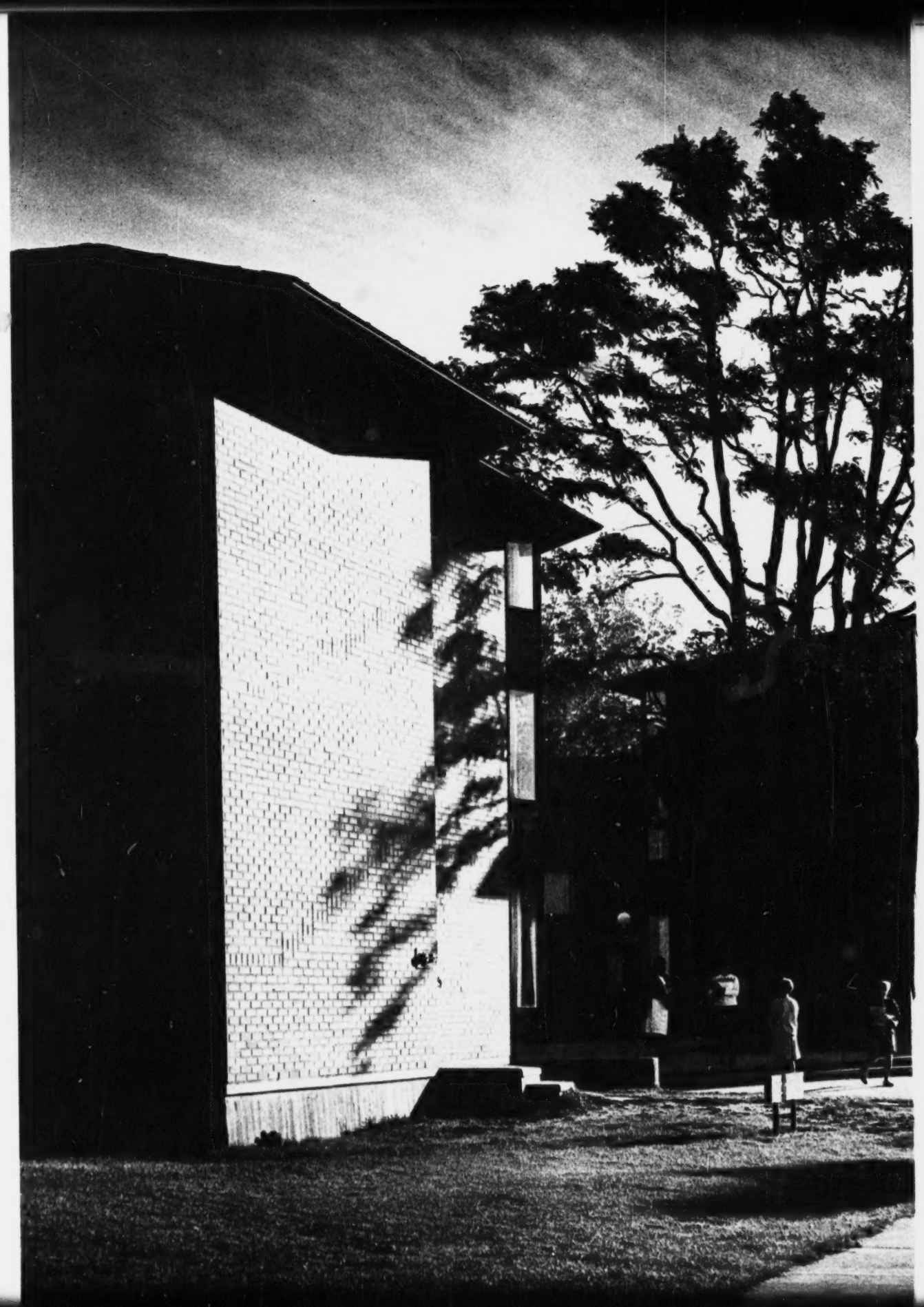
The basic architectural and structural designs for these buildings provided radiation protection for all occupants. Thus, shelter was included without increase in construction cost or compromise in quality.

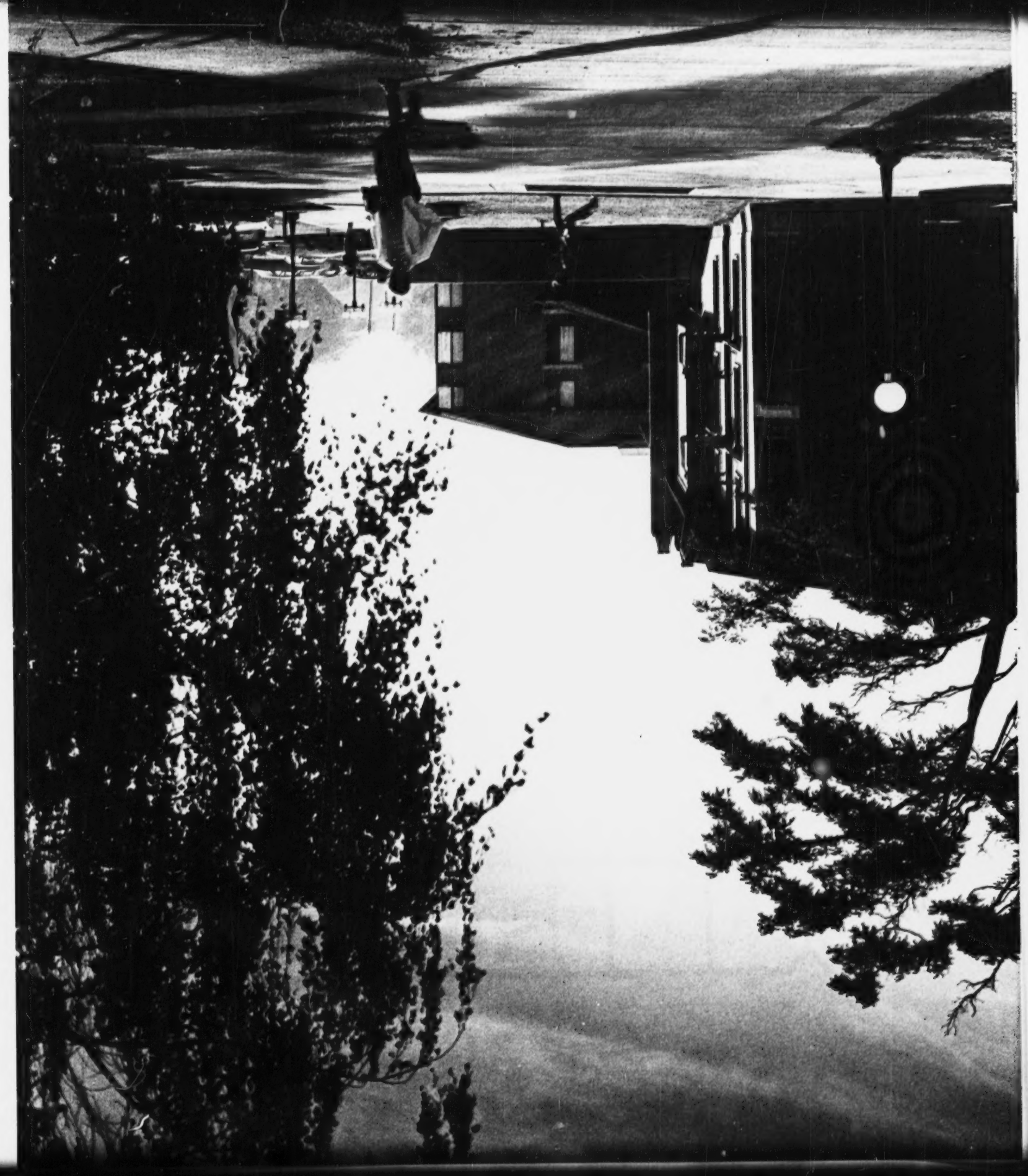
The use of masonry for both the interior and exterior walls provides three essential elements for these designs—good appearance, strength, and weight (for fallout radiation protection). The walls are arranged to satisfy architectural and structural requirements and combine to create an area of adequate fallout protection on the first floor. The shelter areas, most of which are comfortably carpeted, because of normal functional requirements, contain both kitchen and bathroom facilities.

An area of comparable size and equal facilities on the second floor can be utilized for secondary shelter as fallout radiation decays. This area could have been primary protection space if the thickness of the structural slab over the second floor corridor had been increased from 4½ to 8 inches. Since the shelter was not needed, the added expense was not justified.

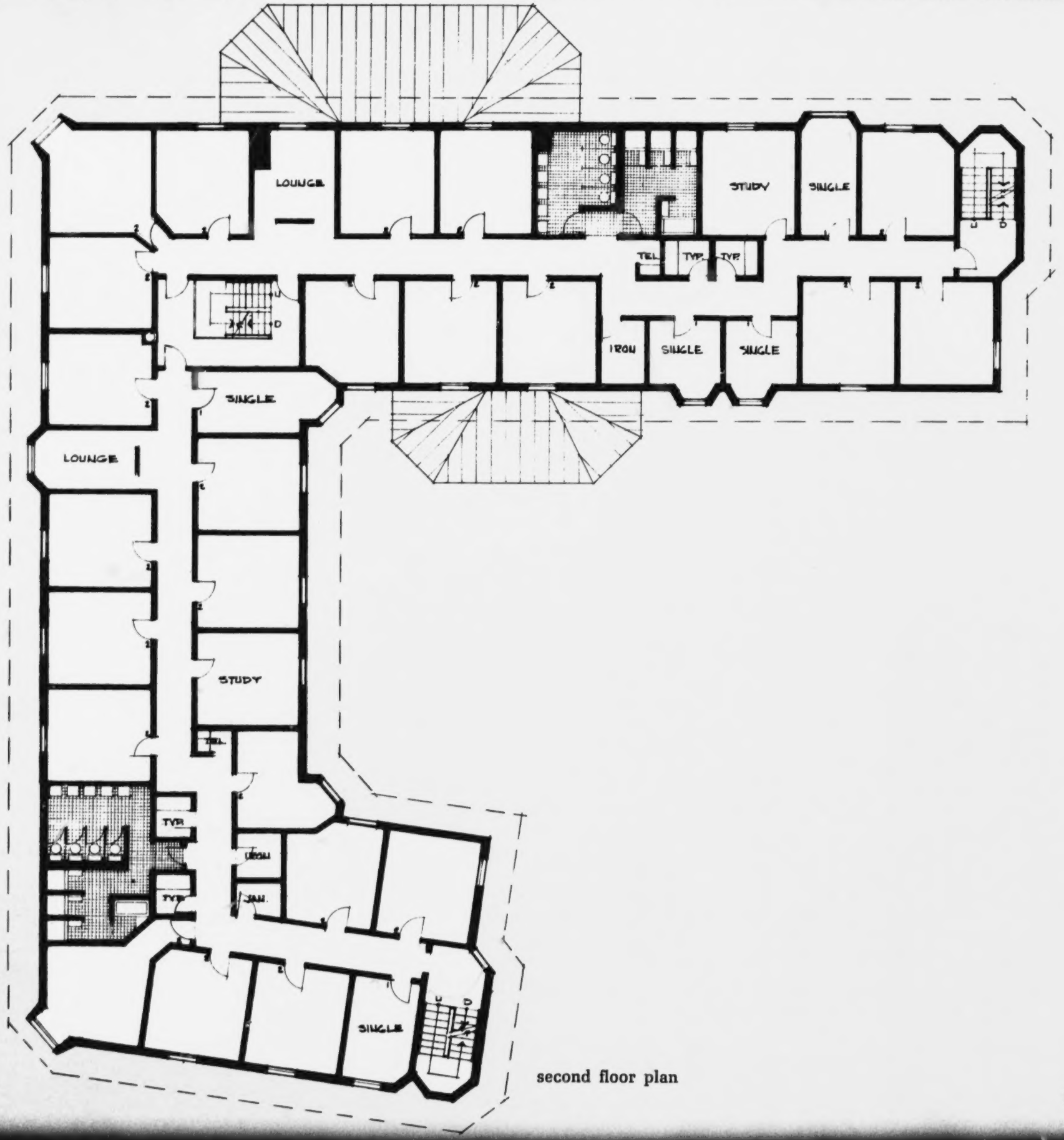
Mutual shielding by these and adjacent buildings also contributes to the protection. Placement of heavy masonry walls around exterior courtyards provides shielding for the lounge areas where large windows were used.

Photographer: Morely Baer, San Francisco, California



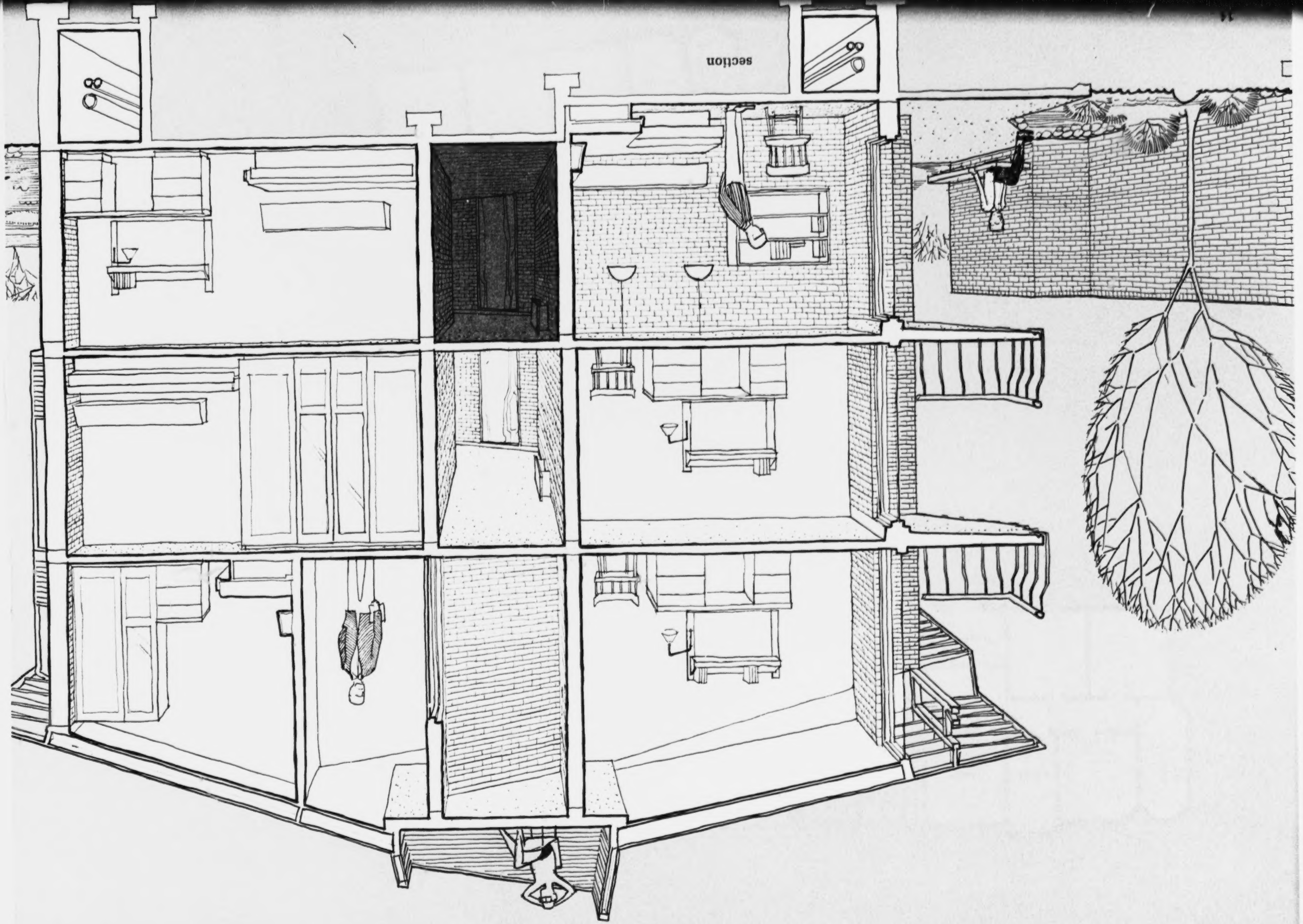


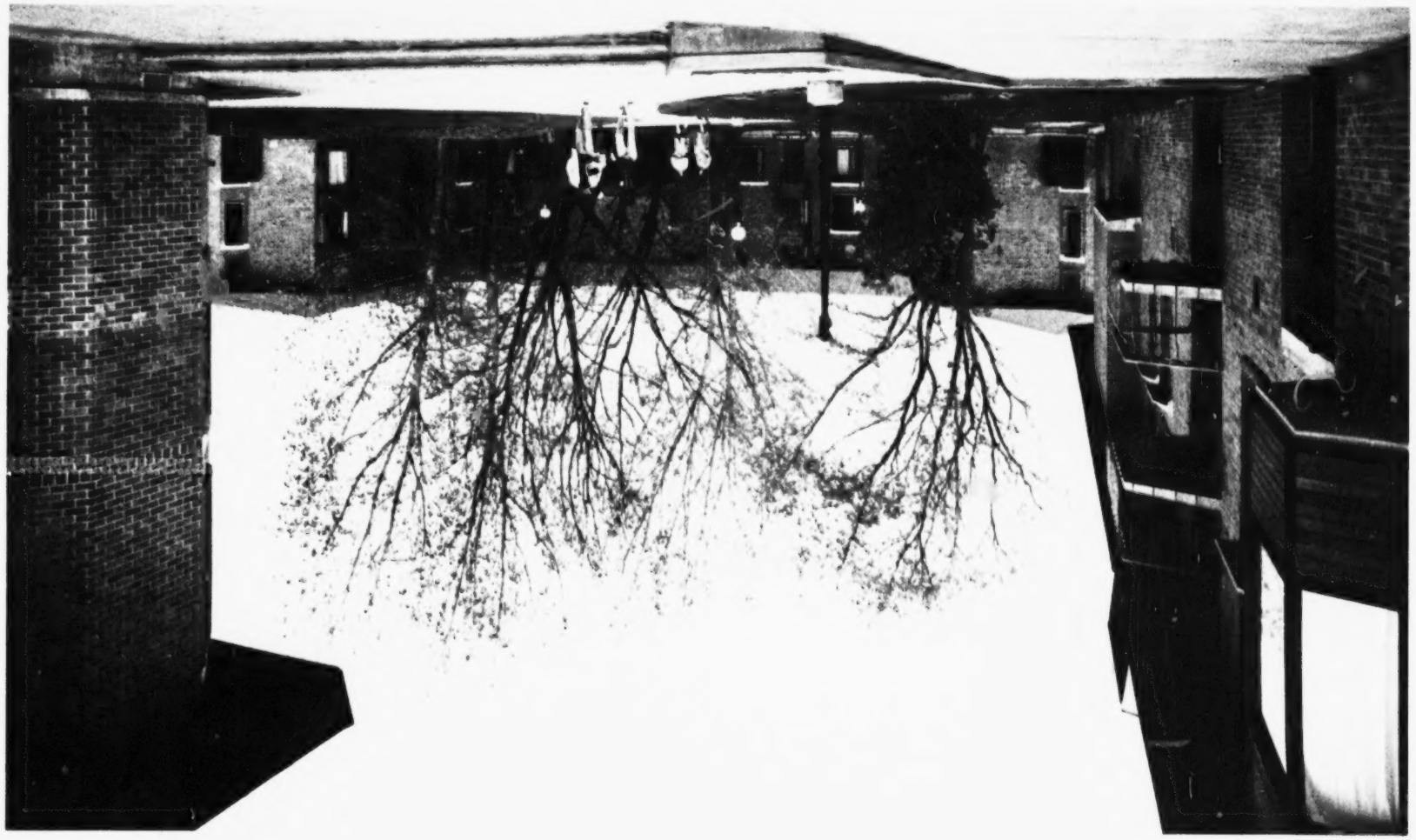
first floor plan

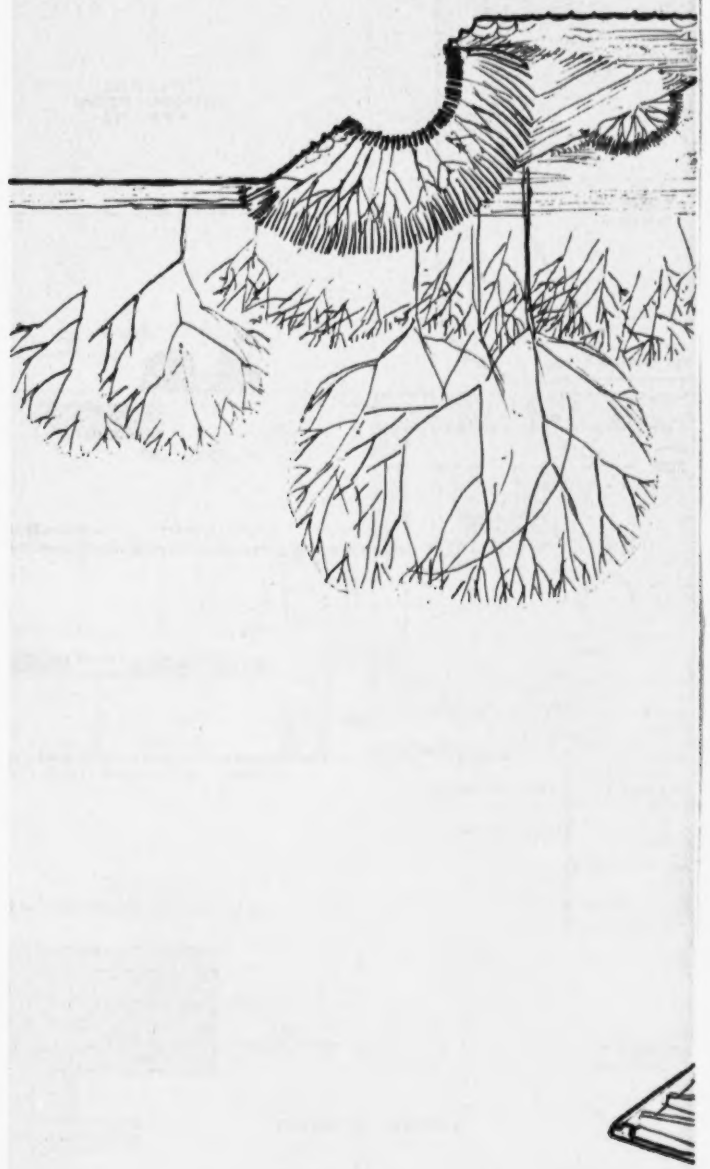


second floor plan

section







First Honor Award

Blackwell Senior High School
Blackwell, Oklahoma

Owner: Blackwell City Schools
Ocie A. Anderson, Principal

Architect: Caudill Rowlett Scott, Houston, Texas

Engineer and Fallout Shelter Analyst:
James R. Cagley, P.E.

Jury Comment

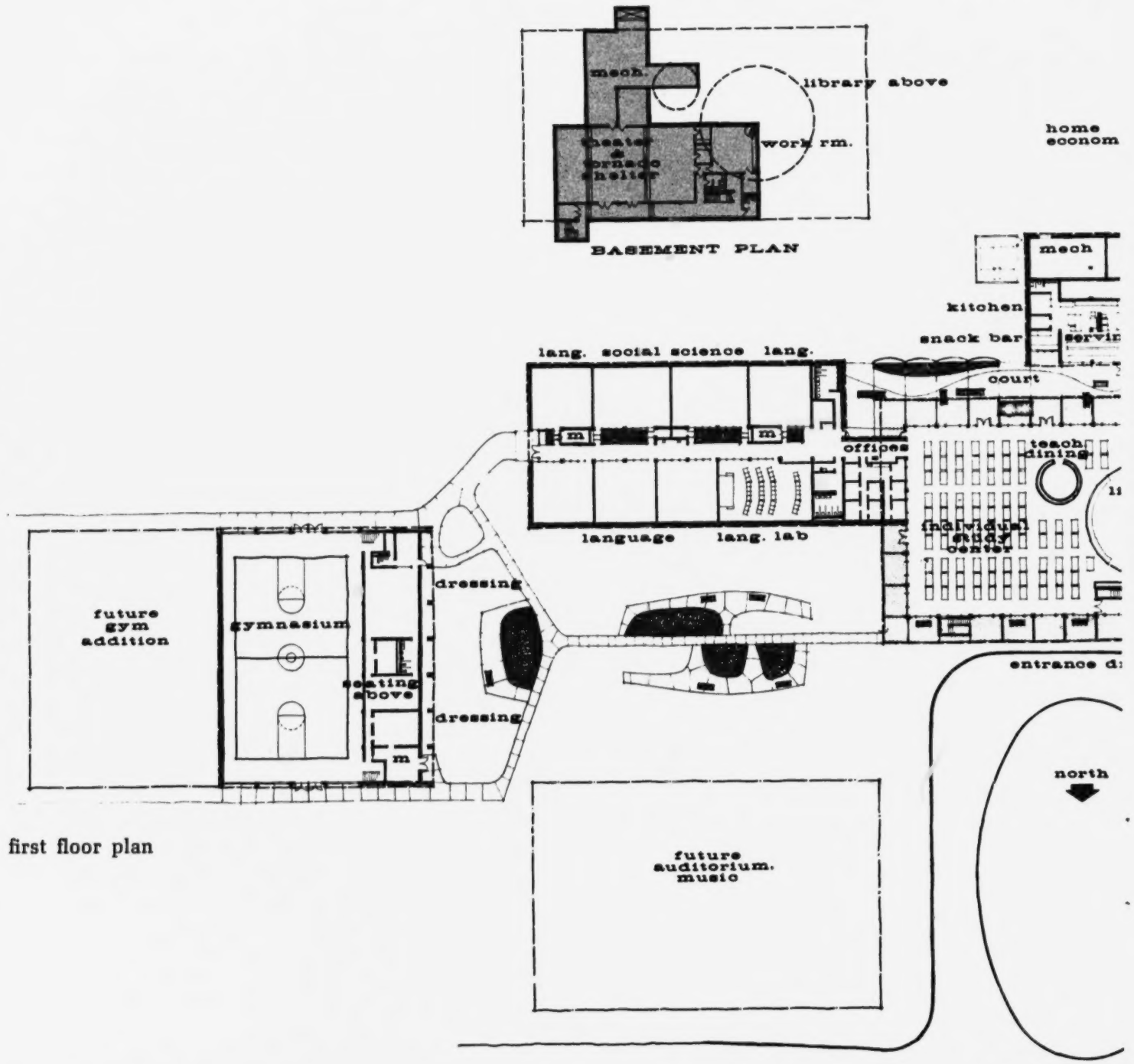
Classroom elements are skillfully organized around a central study area that is the focal point of the school. The building clearly expresses this organization by the contrast of the glassed walls of the central area with the simple windowless classroom wings. The sloped roof over the central portion acts as a unifying element and gives the whole complex a human scale and character seldom achieved in secondary school design.

Architect's Statement

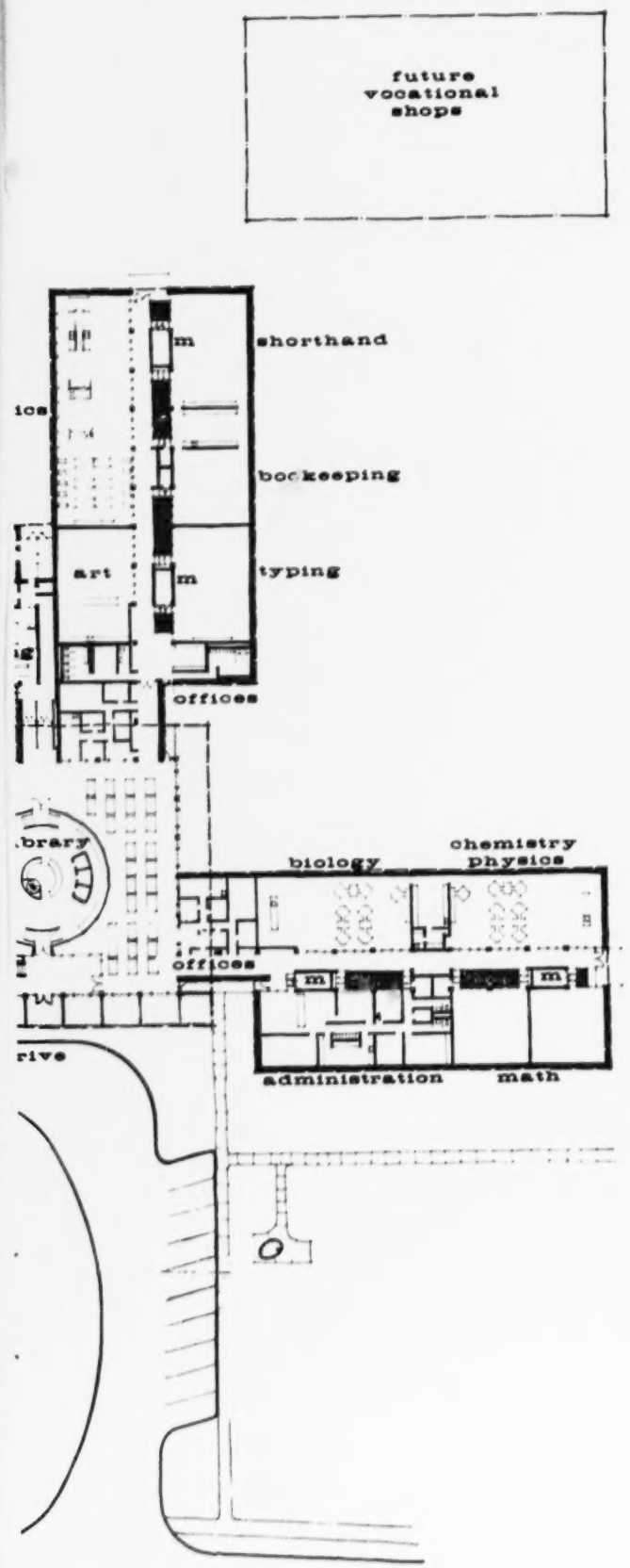
The principal aim in the design of this school was to create a stimulus to individual study outside the classroom. To accomplish this, the school was built around a large, open study center where each of the 600 students has his own home base—desk and locker-drawer—with library resources, teacher consultation and dining areas arranged around the student area.

Beneath the study center, a little theater carries out the theme of personalized learning. It also provides an emergency facility, dual-purpose in its own right, protecting the school community against possible fallout radiation hazards and probable tornadoes. The combined facility has a Protection Factor of 60 and provides a specialized tornado and fallout shelter for 406 persons.

Overall design of the school makes use of steel beams, purlins and trusses and load-bearing masonry walls.



first floor plan

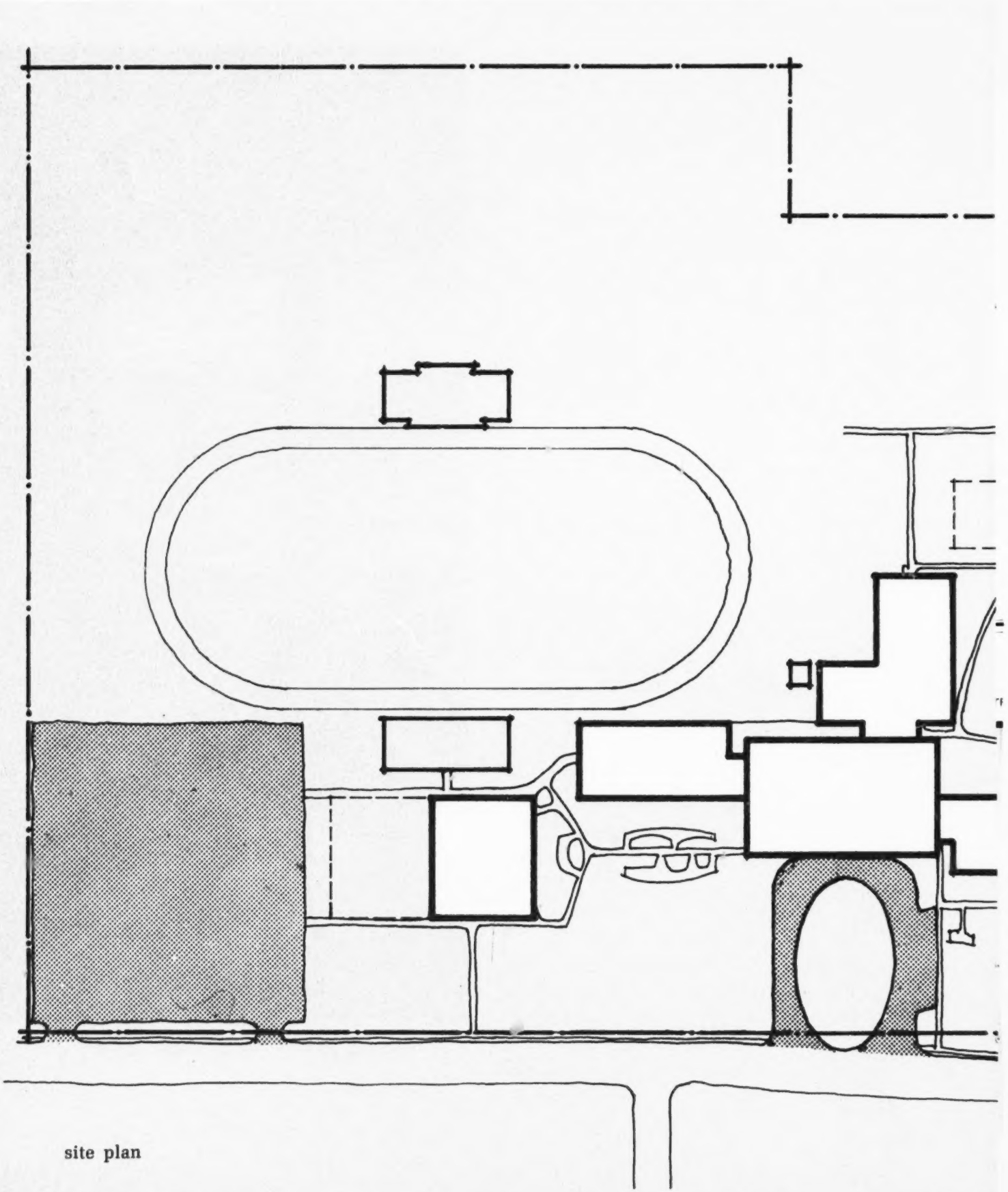


view of study area from corridor

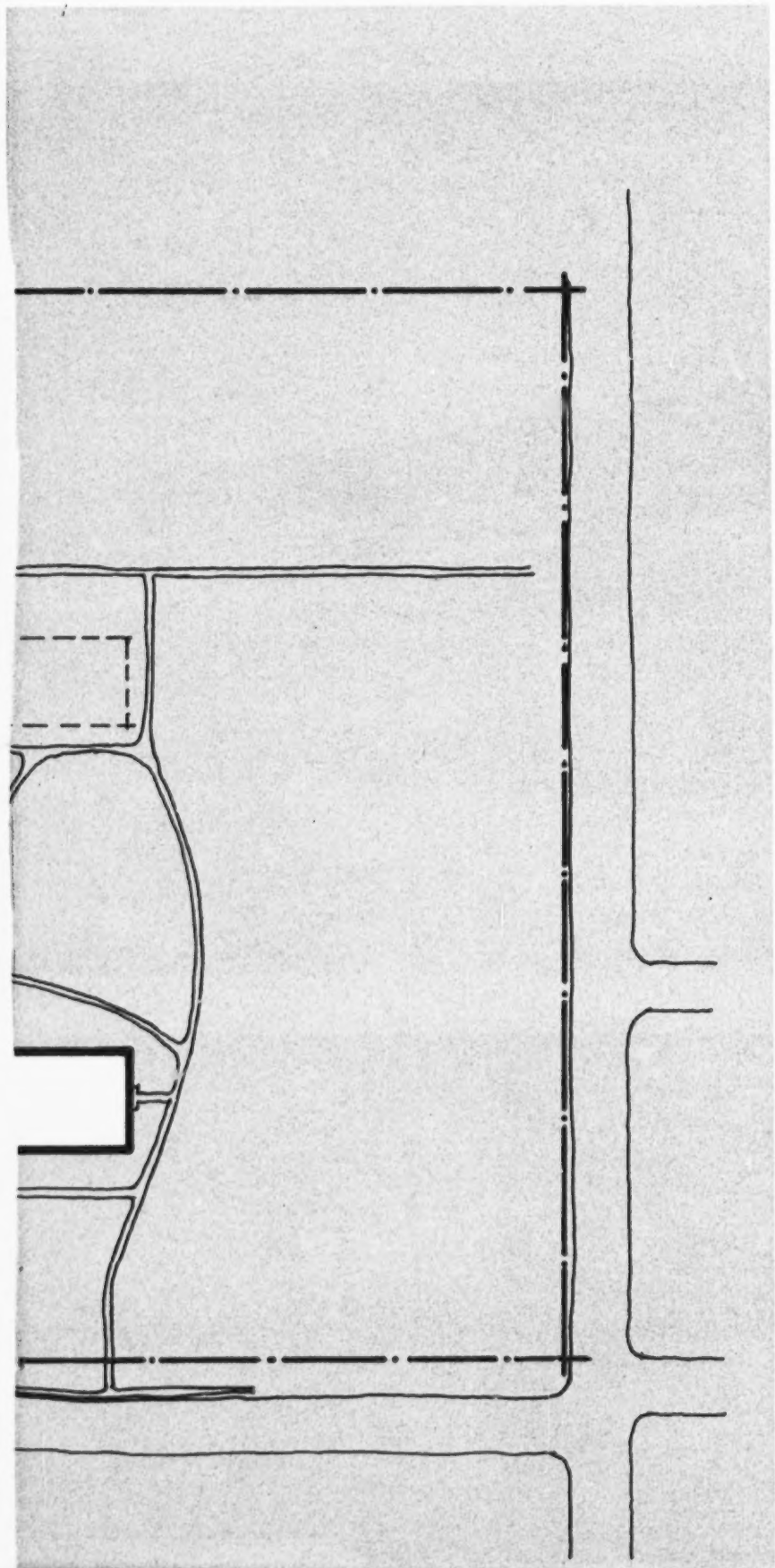
Shelter Analyst's Remarks

The combination theater, tornado shelter, and fallout shelter area was easily achieved through the use of conventional construction methods and materials. The reinforced concrete walls and first floor slab provides the basic protection. Even though lightweight construction was used, over the shelter area, the protection is provided by the distance between the shelter area and the fallout particles on the roof. This combination of materials and spaces which were required under the program yields a fallout shelter at no additional cost to the owner.

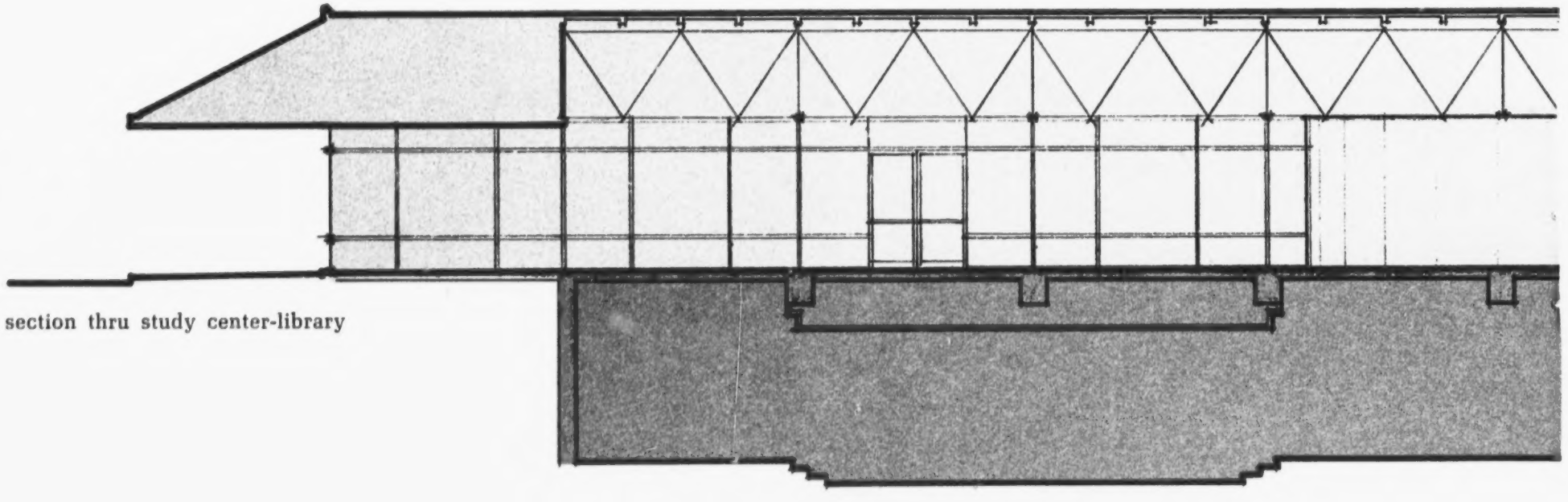
Photographer: Bob Hawks, Inc., Tulsa, Oklahoma



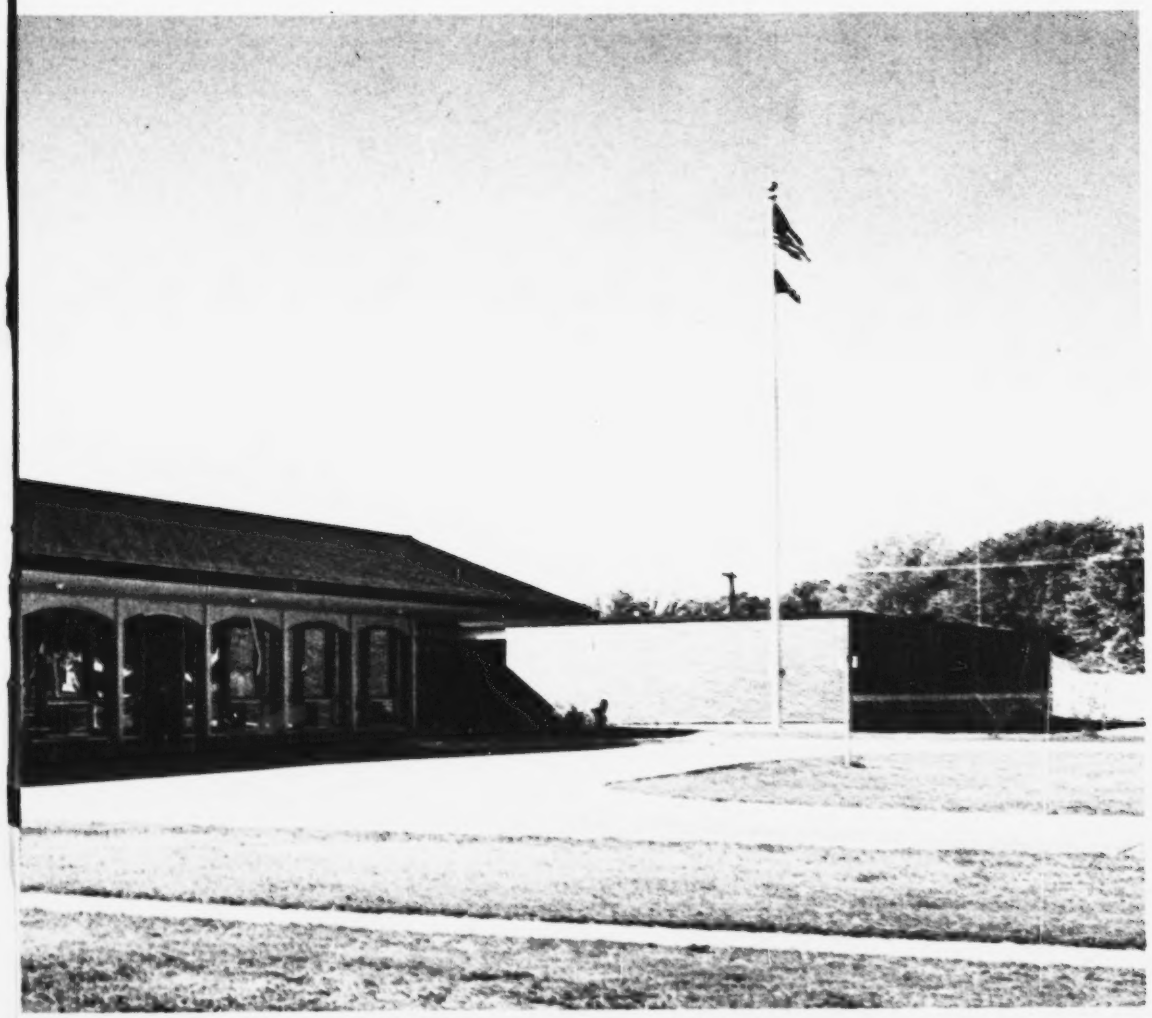
site plan



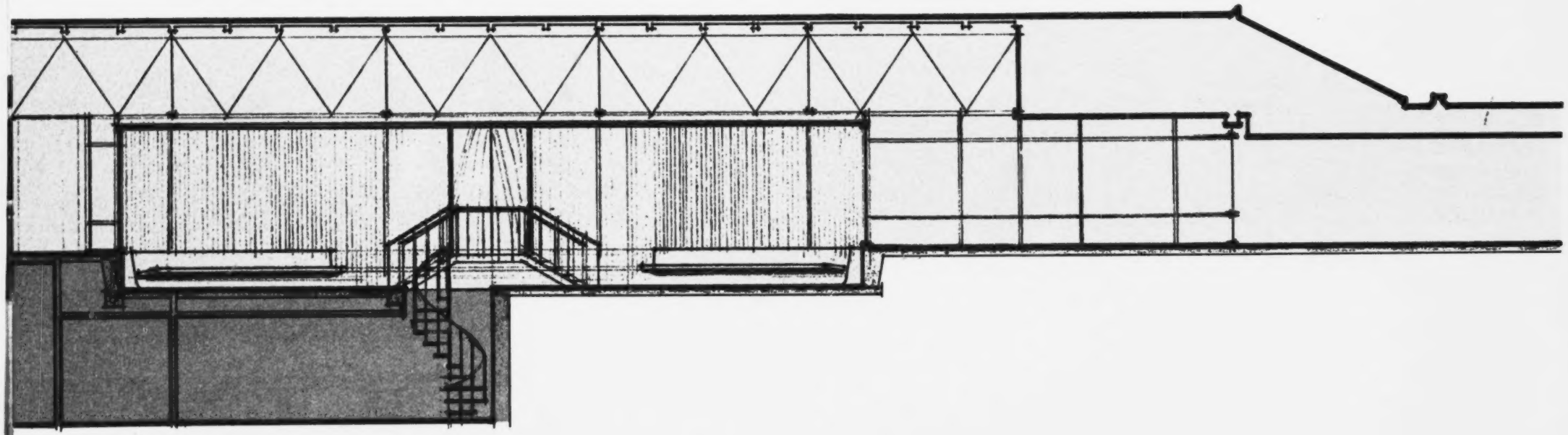
combined theater, tornado shelter, and fallout shelter

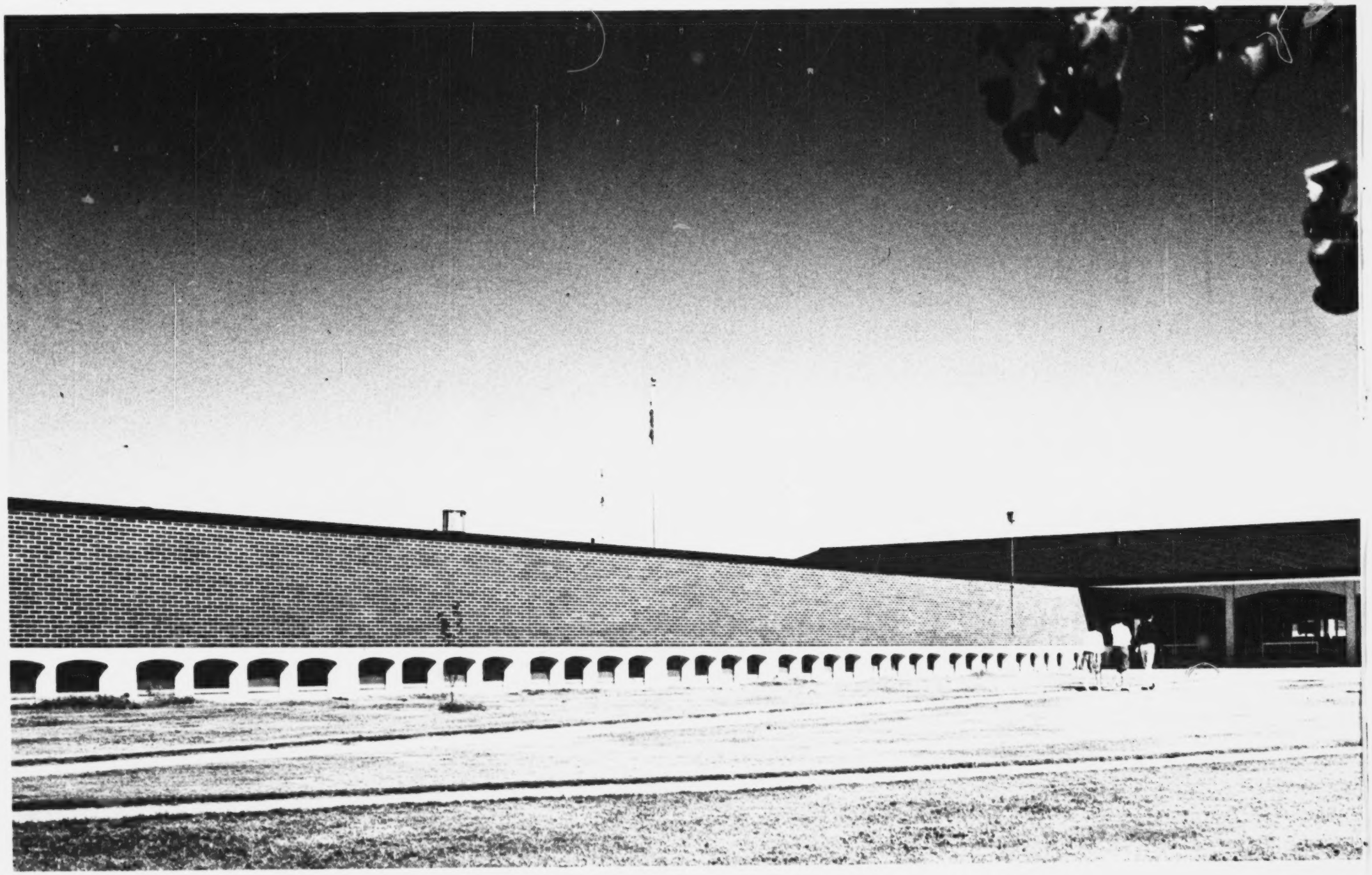


section thru study center-library

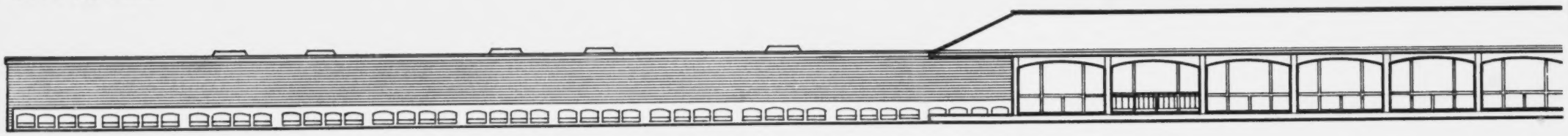


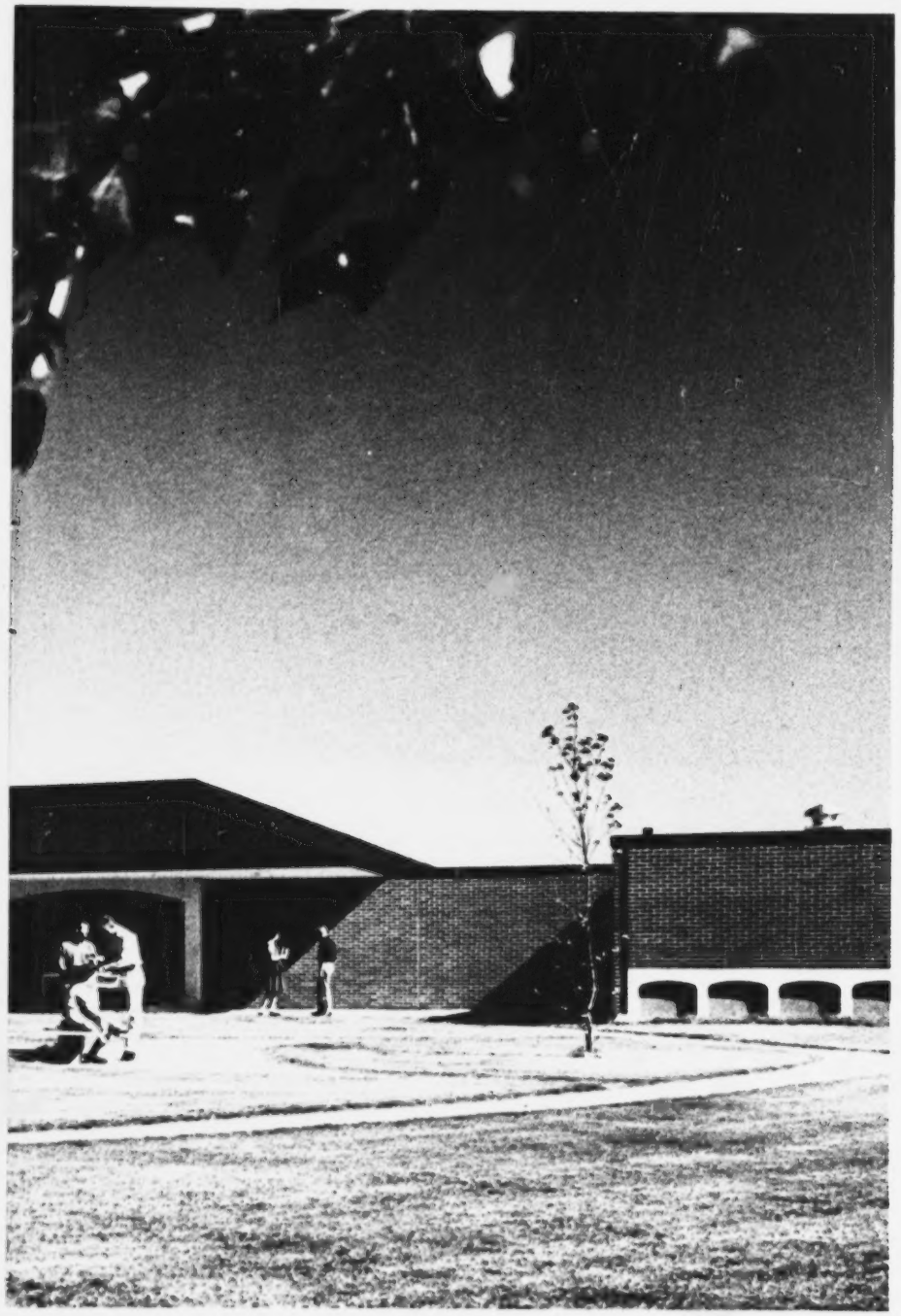
exterior from entrance drive



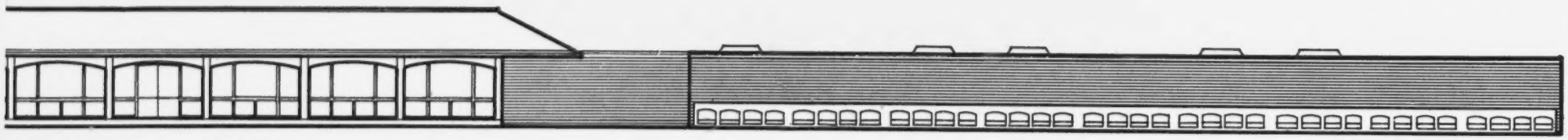


north elevation





exterior from southwest



First Honor Award

Chancery of the Royal Netherlands Embassy, Washington, D. C.

Owner: The Government of the Kingdom of the Netherlands

Architect: IR. P.H. Tauber, B.I., B.N.A. Beatrixlaan 2, Alkmaar, Holland and Deigert and Yerkes and Associates, Washington, D. C.

Engineer (Structural): Carl C. Hansen Silver Spring, Maryland

Engineer (Mechanical & Electrical): Cotton and Harris, Washington, D. C.

Landscape Architect: Boris Timchenko Washington, D. C.

Fallout Shelter Analyst: Arvydas Barzdukas Falls Church, Virginia

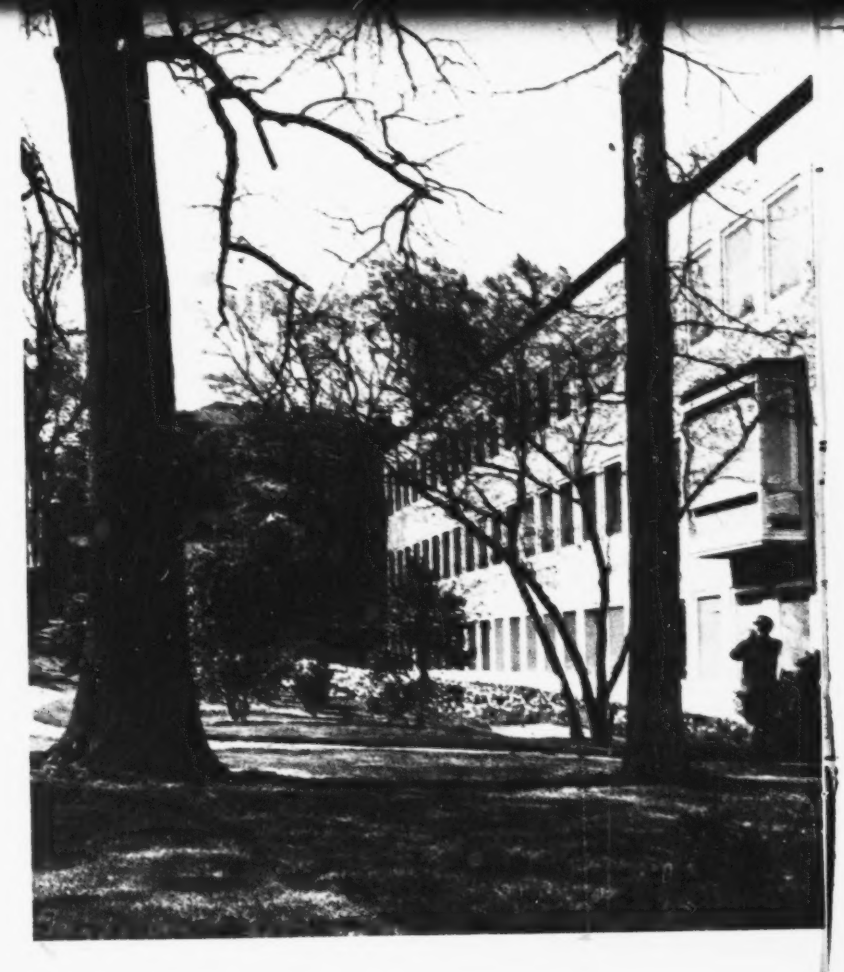
Jury Comment

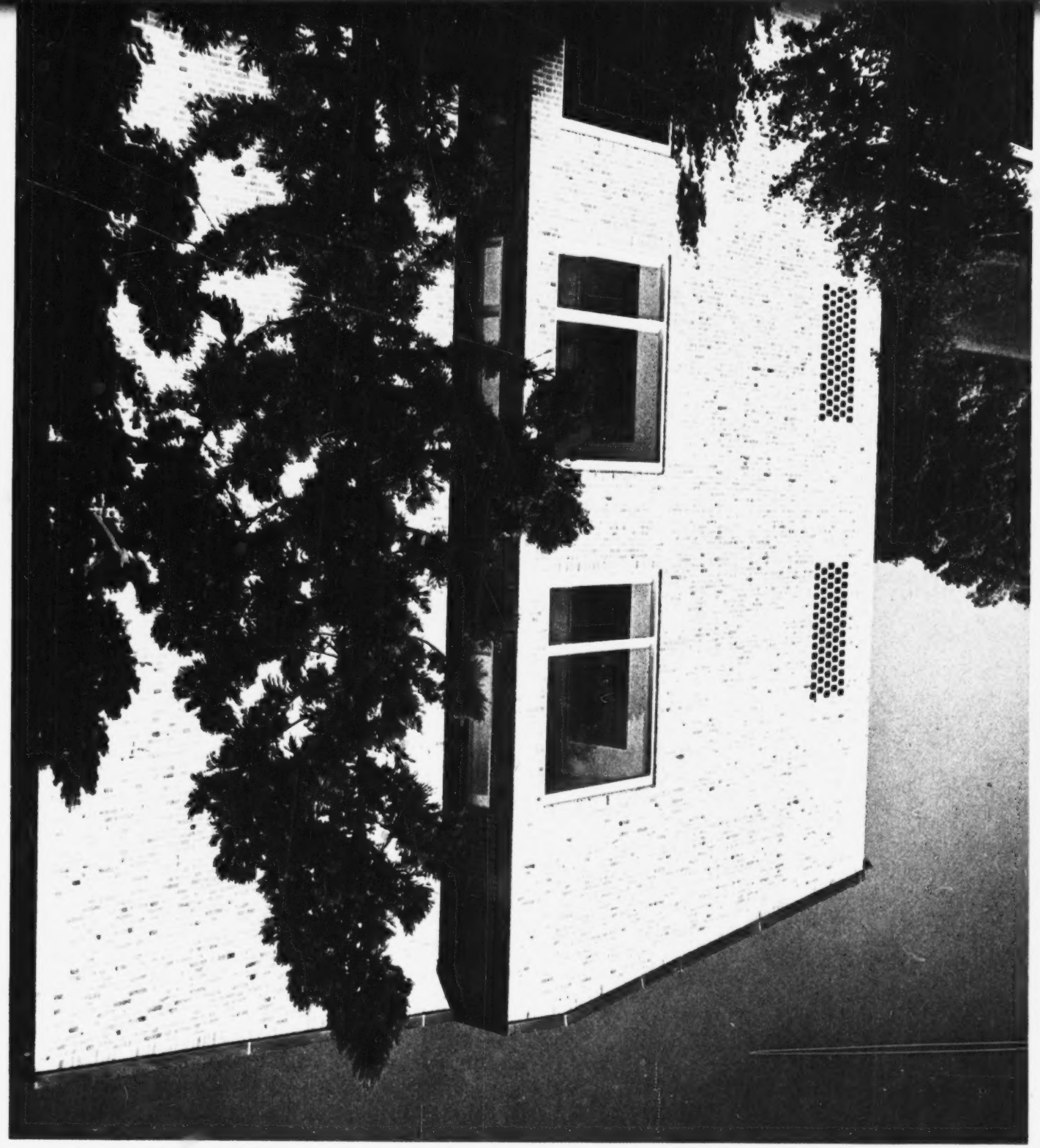
This is an unusually fine solution to the problem of siting a complex building on steeply sloping ground. The juxtaposition of building elements and landscape features is expertly handled, making them belong to their site. Restrained use of masonry and sensitive design of window openings give this important building a quality and scale appropriate to its use and to the surrounding neighborhood.

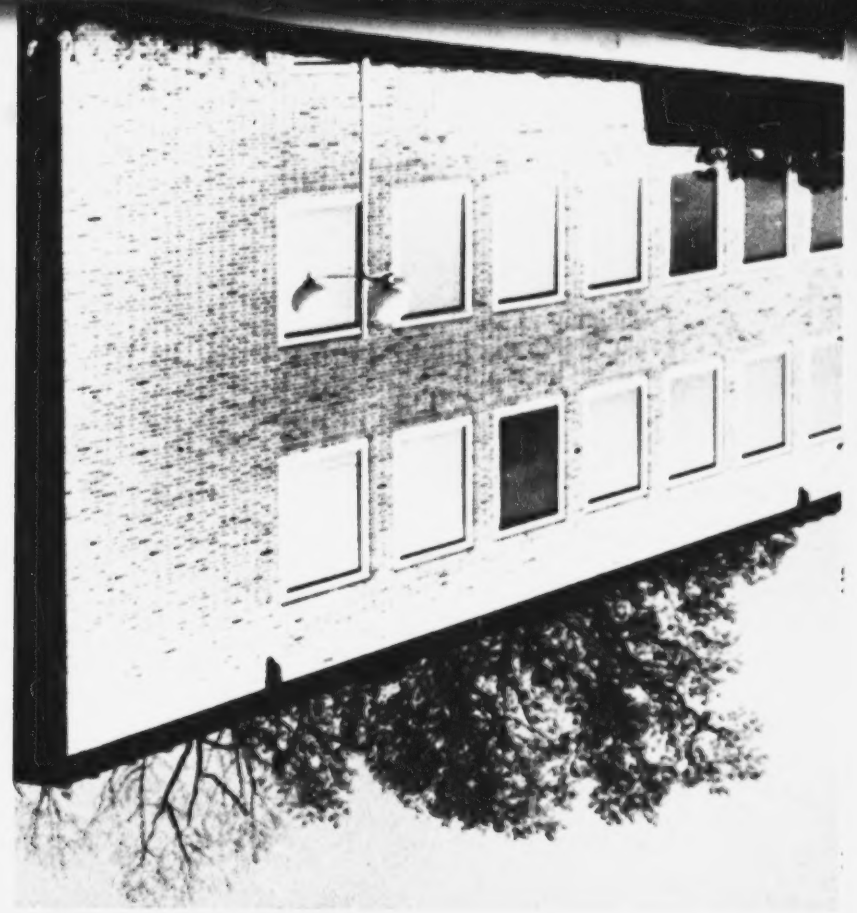
Architect's Statement

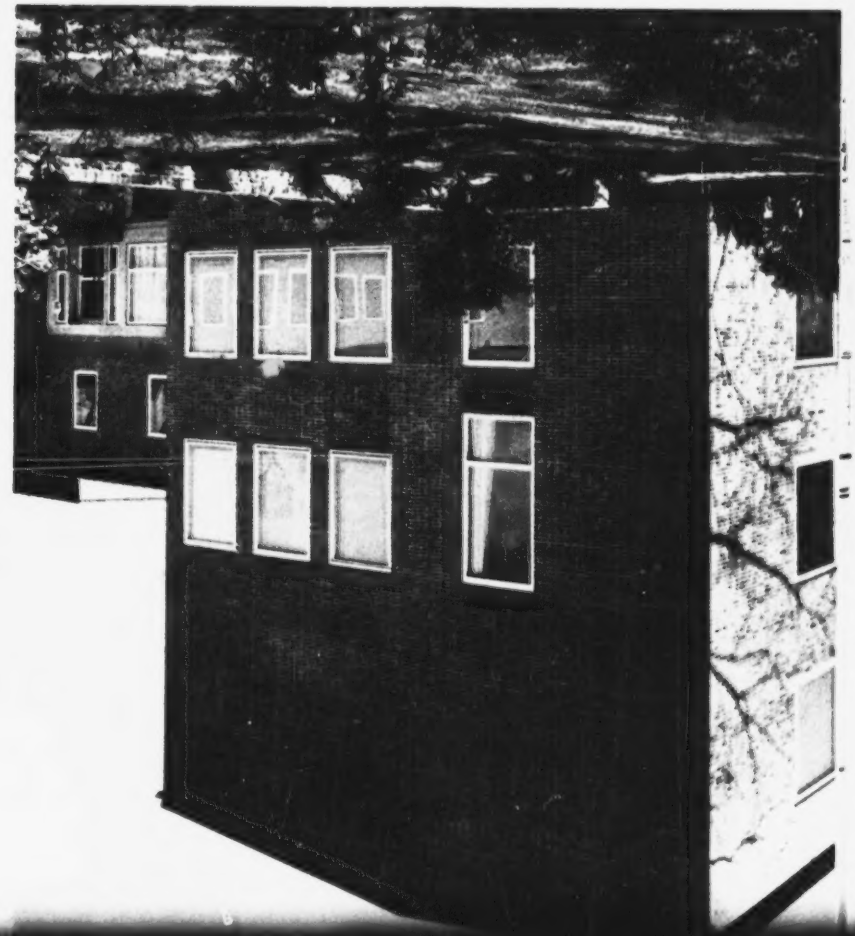
The Netherlands Chancery is in Washington; the architect who designed it has his office in Holland. This might have created major problems of coordination but, due to the cooperation of all concerned as well as close coordination between the Dutch and American architects, the inevitable difficulties which arose were handled with a minimum of delay.

An unusual feature of the project arose from the desire of the Netherlands Government to use Dutch materials wherever possible. The brick, stone, windows, movable partitions, storage walls and furniture were imported









from Holland. As a result, the building has qualities of solidity and permanence which make it characteristically Dutch and ideally suited for radiation protection.

The Chancery is located in a residential neighborhood, and the architects made every effort to make the building an inconspicuous and harmonious addition to the community. It is set well back from the street and is partially screened by planting. To reduce its apparent bulk, the building was designed with two main masses which are connected by a link. Parking lots are dug into the hill, and two of them are double decked, thus minimizing the visible area of paving and parked cars. Finally, the materials and the character of the design are compatible with the domestic character of the buildings in the neighborhood.

The form of the Chancery depends on the interplay between its masses and the sloping site. It fits easily and naturally into the rolling terrain.

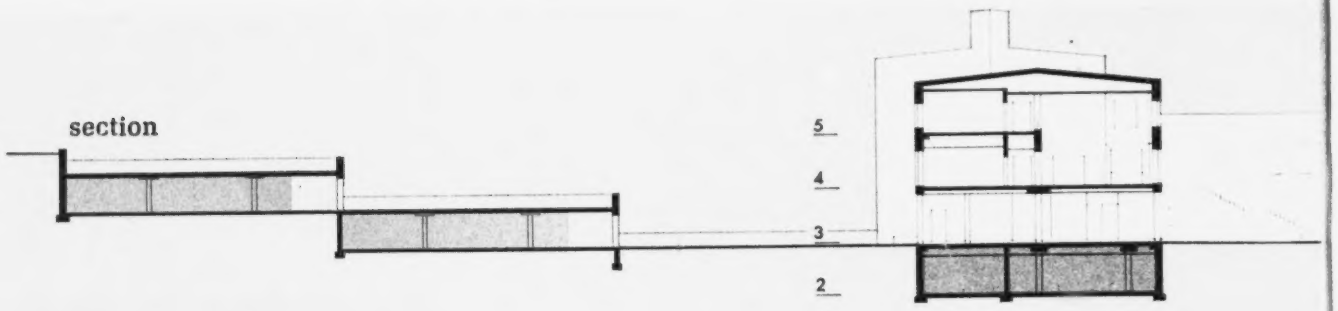
White window frames, which create a strong contrast with the color of the brick, do much to determine the quality of the design. The reveals are shallow—a common characteristic of buildings designed for a frequently cloudy climate like that of Holland. The strength of the visual pattern depends on the contrast between materials rather than the use of plastic forms to create a pattern of light and shade.

Wood is used effectively in many of the important rooms. Some of the ceilings achieve an unusual richness from both the grain and color of the wood and the use of alternating recessed and projecting boards. The contrast between these ceilings and the white plaster walls produces an effect which emphasizes the qualities of both.

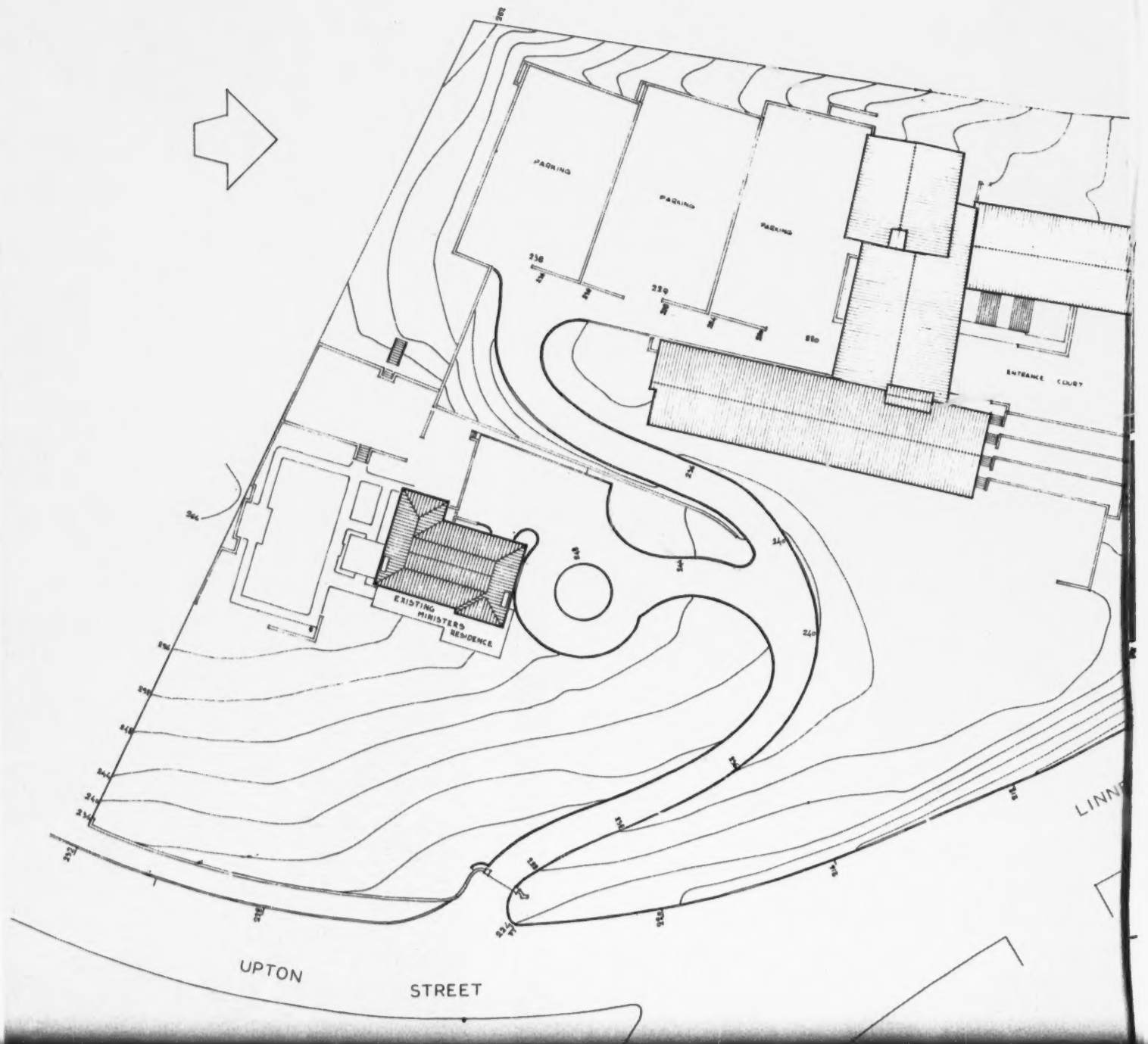
Like many of the building materials, the furniture was made in Holland. It echoes the straightforward, simple and unostentatious modernity of the architectural design.

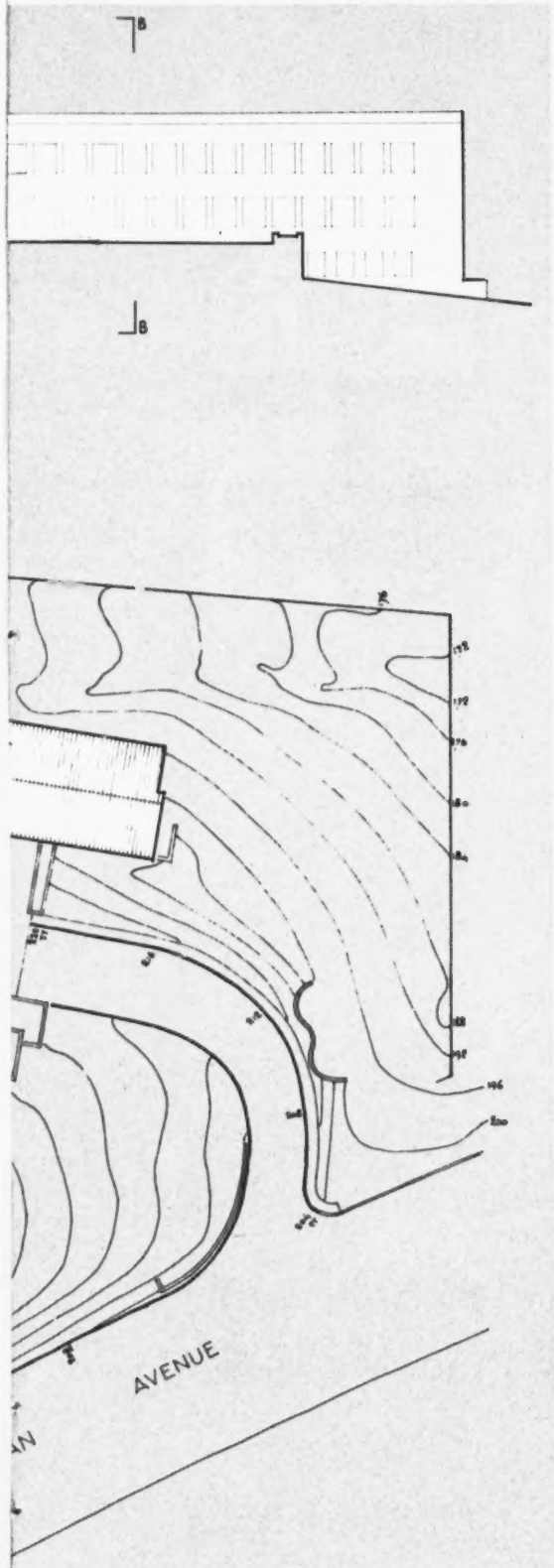
The architect of the Chancery was unusually successful in solving a difficult problem: To produce a building which fits gracefully into its surroundings while clearly suggesting the nationality of its origin.

section



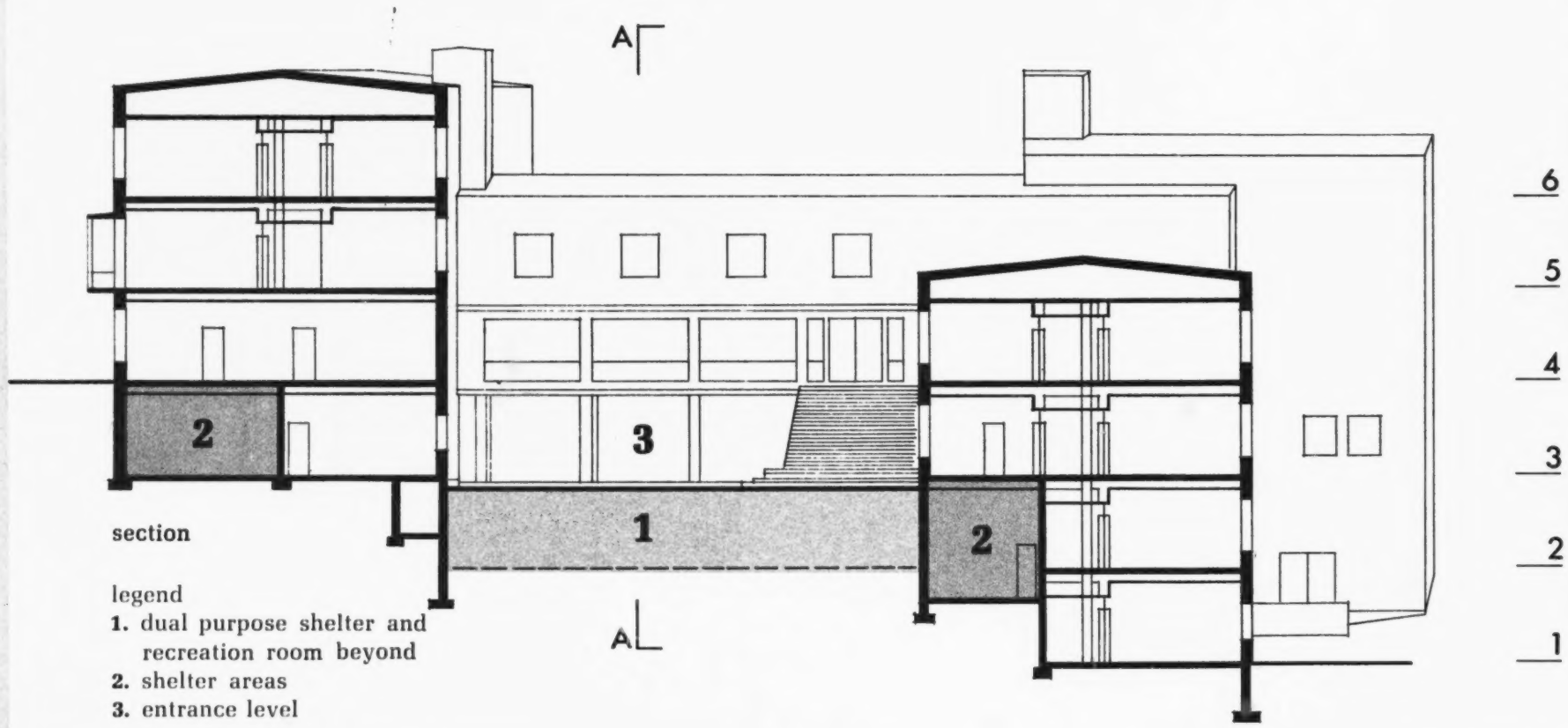
site plan





recreation room

recreation room



section

legend
1. dual purpose shelter and recreation room beyond
2. shelter areas
3. entrance level

Shelter Analyst's Remarks

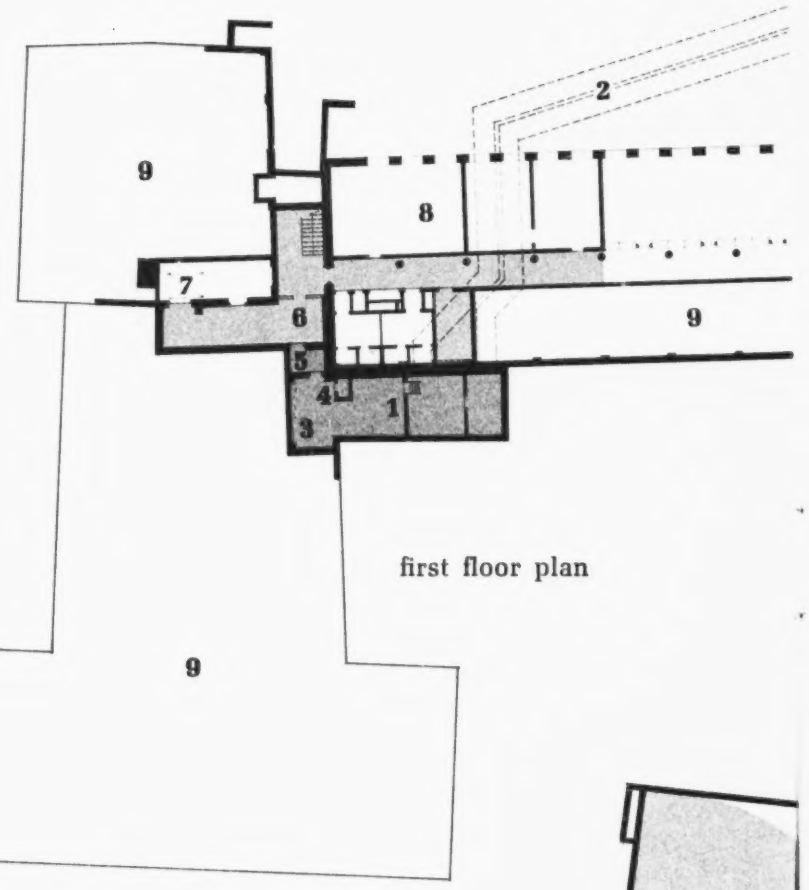
The Recreation/Shelter and its mechanical equipment room have been designed to resist 15 p.s.i. overpressure. This was a requirement of the owner but not of the Office of Civil Defense. Entrances to both the Recreation/Shelter and its mechanical equipment room are baffled by introducing two right-hand turns and are provided with blast-resistant doors. Access to the mechanical equipment room from the shelter is by a ladder in the connecting air shaft. The shelter has its own toilet facilities, pump, well and 1,500-gallon water storage tank. A generator, which is switched to supply emergency power to essential areas of the Chancery in case of power failure, is also included. The pump, well and generator are above and beyond OCD shelter requirements. The mechanical equipment is designed to heat or cool the Recreation/Shelter area during normal as well as emergency operation. The long air intake and exhaust ducts, 3 feet in diameter, can also be used as escape hatches should the upper building collapse and block both exit stairways. In the event the building remains intact, the protection provided by the shelter is well in excess of the OCD minimum requirement of PF 40. Even under the assumption that the driveway directly overhead becomes contaminated, the overhead mass still affords a Protection Factor of 660.

Several other areas of the building were selected for analysis, using the Equivalent Building Method (Shelter Design and Analysis, Vol. 2, Oct. 1964), to obtain approximate protection factors with the following results:

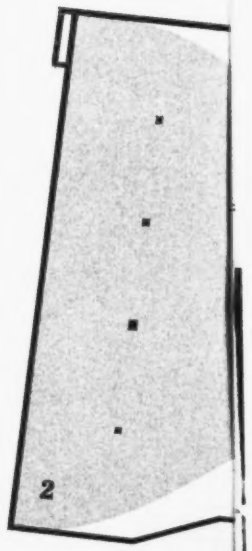
Parking Garages: Although calculated to afford an overall protection factor of more than 60, this area contains no securable storage place for food, water and other shelter supplies. Only approximately three-fifths of the entire area can be considered adequate shelter, in any event, since the area adjacent to the pierced masonry wall does not provide PF 40.

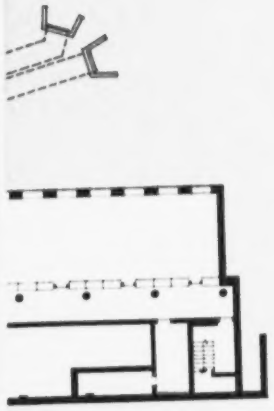
Parts of the First Floor Corridor in Central and West Wings: These areas will provide excellent fallout shelter almost equal in protection factor to that of the blast shelter area.

legend
1. mechanical equipment room for dual purpose shelter and recreation room
2. air intake and exhaust ducts
3. well and water storage tank
4. ladder in air shaft from shelter
5. vestibule with blast door
6. shelter area
7. elevator
8. building services
9. unexcavated



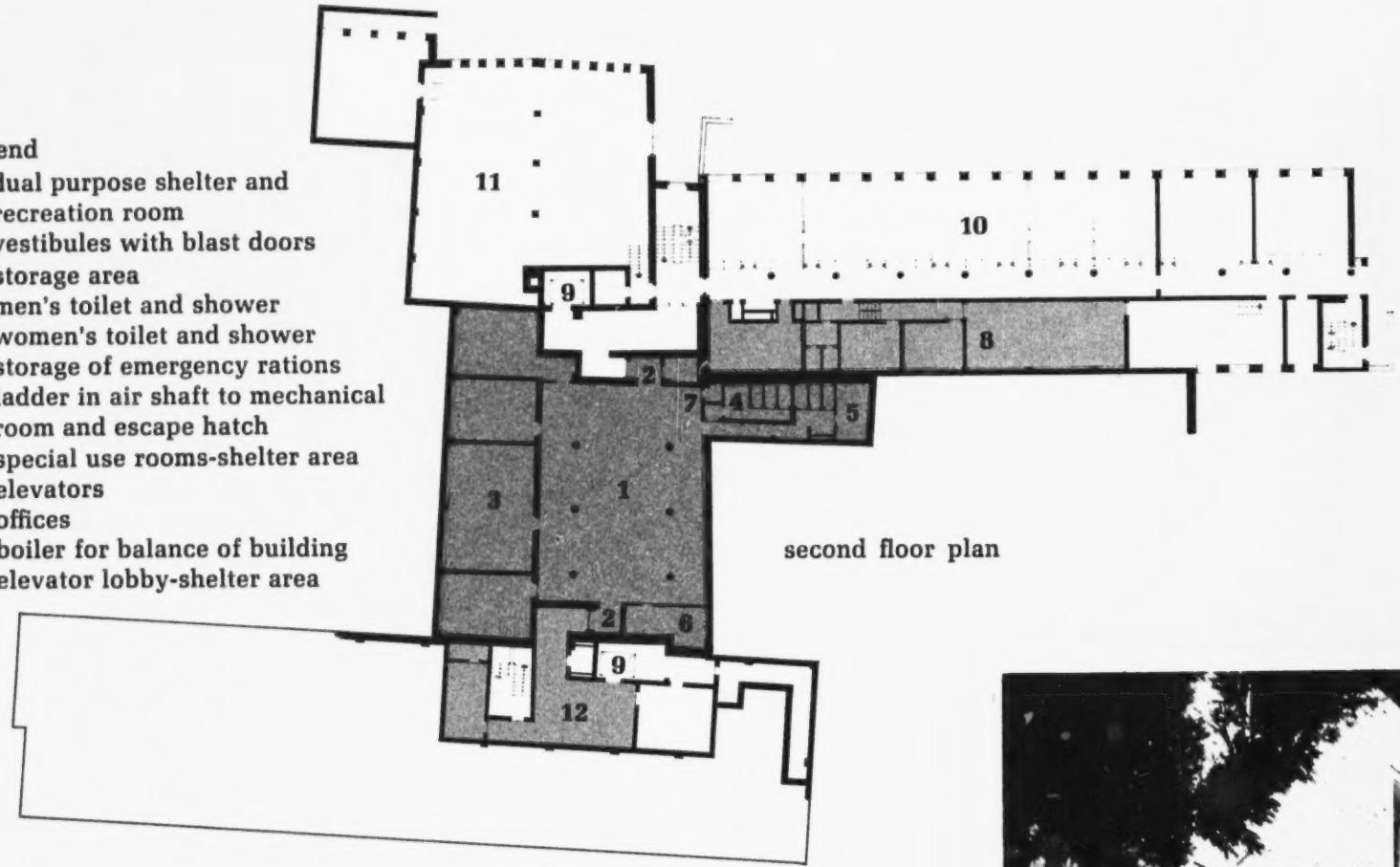
first floor plan



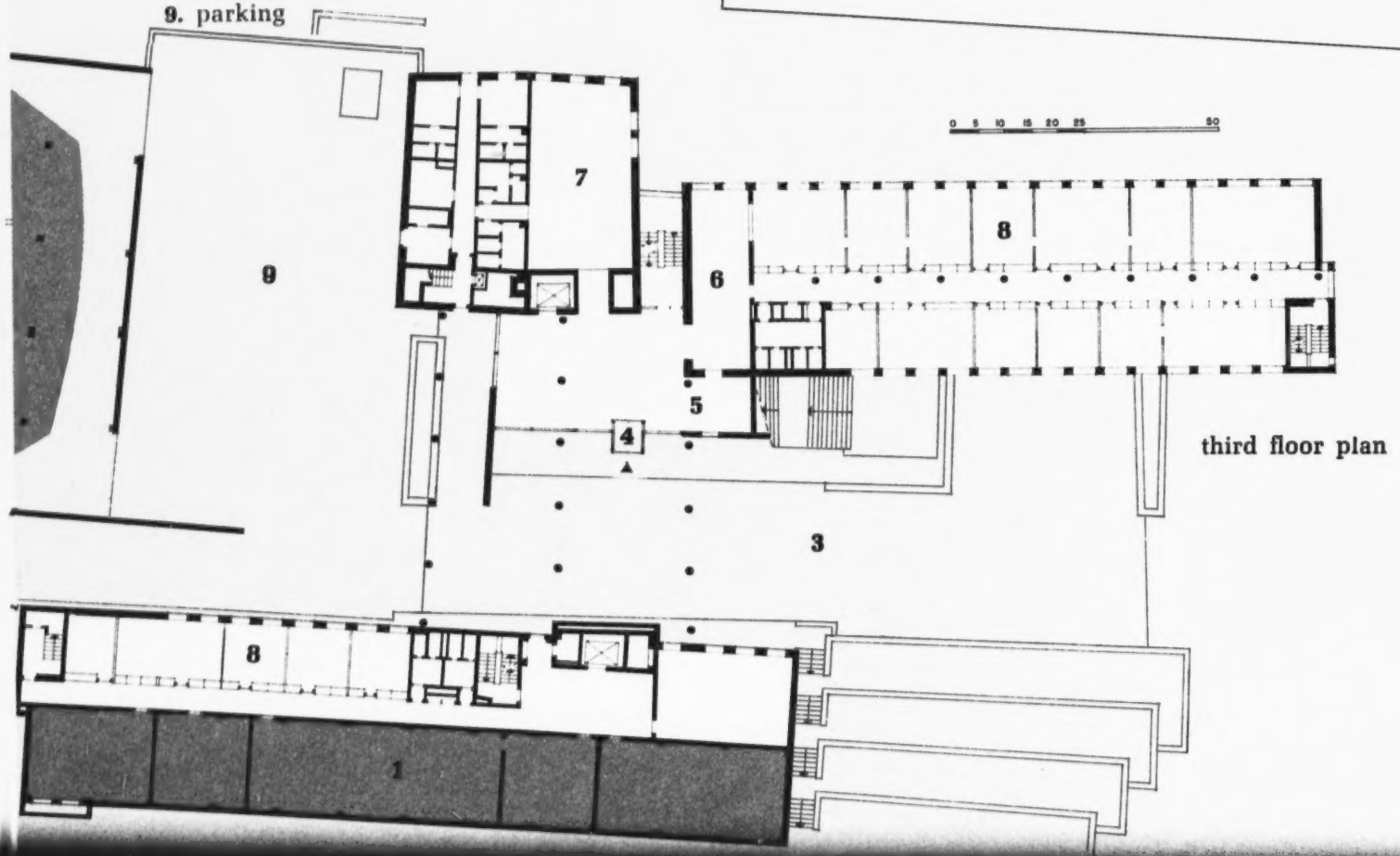


legend
1. storage rooms—shelter area
2. parking garage—protected space
3. entrance courtyard
4. main entrance
5. reception
6. waiting
7. coatroom
8. offices
9. parking

legend
1. dual purpose shelter and recreation room
2. vestibules with blast doors
3. storage area
4. men's toilet and shower
5. women's toilet and shower
6. storage of emergency rations
7. ladder in air shaft to mechanical room and escape hatch
8. special use rooms-shelter area
9. elevators
10. offices
11. boiler for balance of building
12. elevator lobby-shelter area



second floor plan



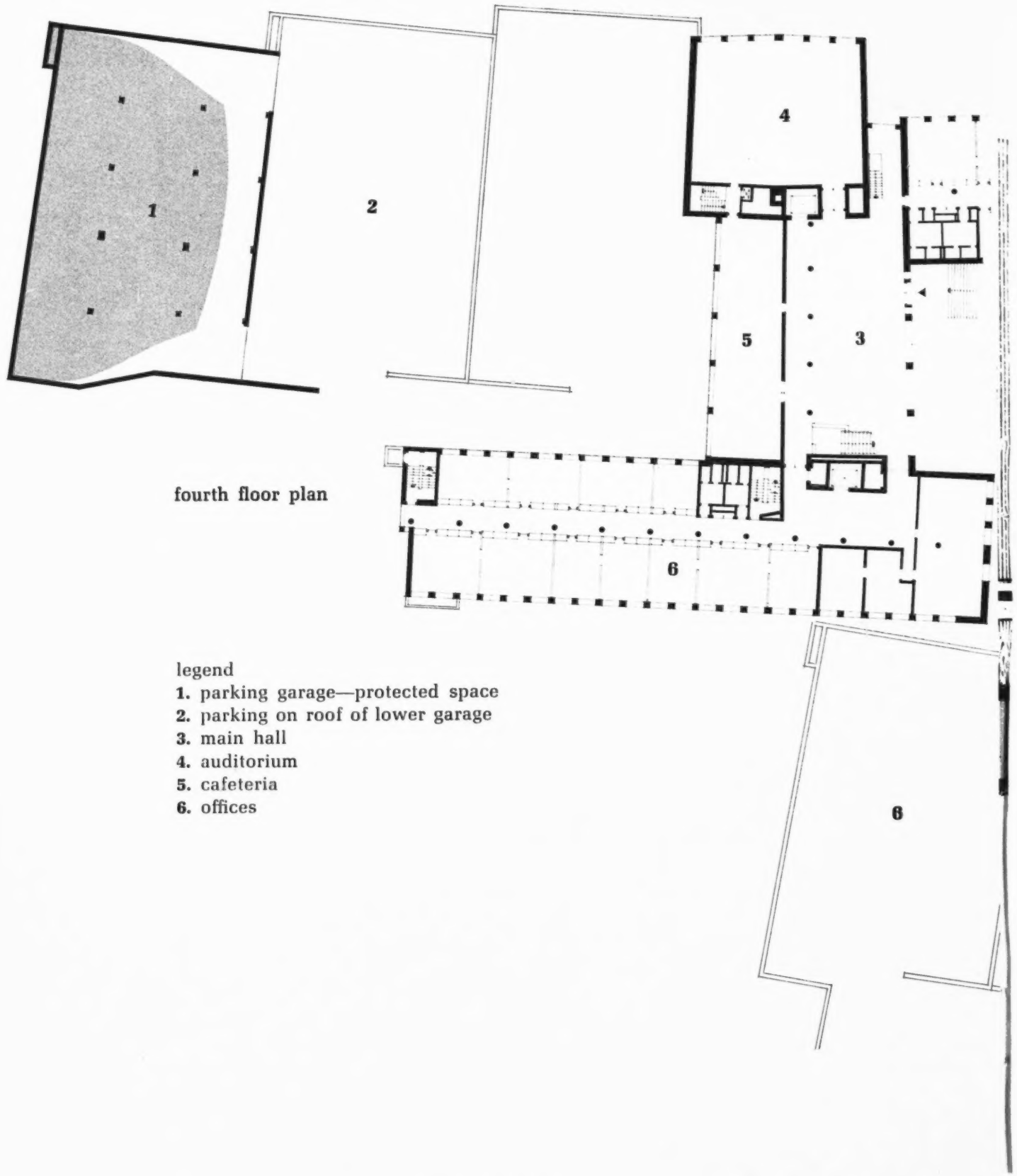
third floor plan

Second Floor Elevator Lobby (East Wing) and Special Use Area, Second Floor (West Wing): The Lobby provides excellent shelter well in excess of PF 750. Although it was not calculated separately, equally good PF would be obtainable in the Women's Lounge. A PF 77 in the Special Use Area is conservative. This would be improved if overall roof contribution were taken into account and if the area were considered to be a core of an 87-foot by 62-foot fictitious building.

Storage Area, Third Floor (East Wing): Only the most critical part of this area was calculated and PF1000 was obtained.

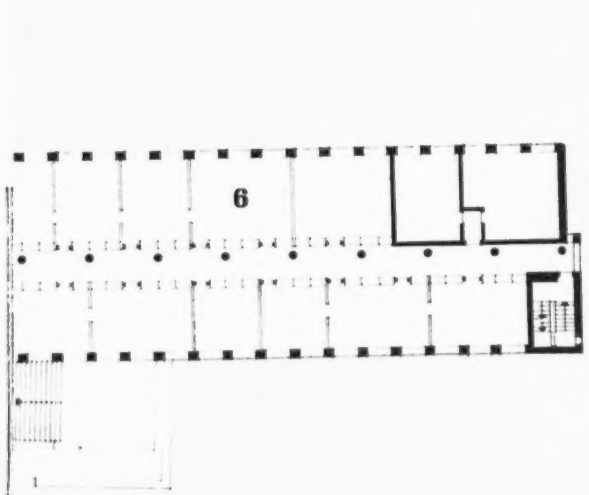
A check of a typical floor resulted in PF 14.6 which indicated that the remainder of the building is not suitable for shelter without upgrading. The introduction of heavier interior partitions would produce a satisfactory shield for most of the corridor areas but there is an abundance of shelter elsewhere without this, and the added cost is not justified.

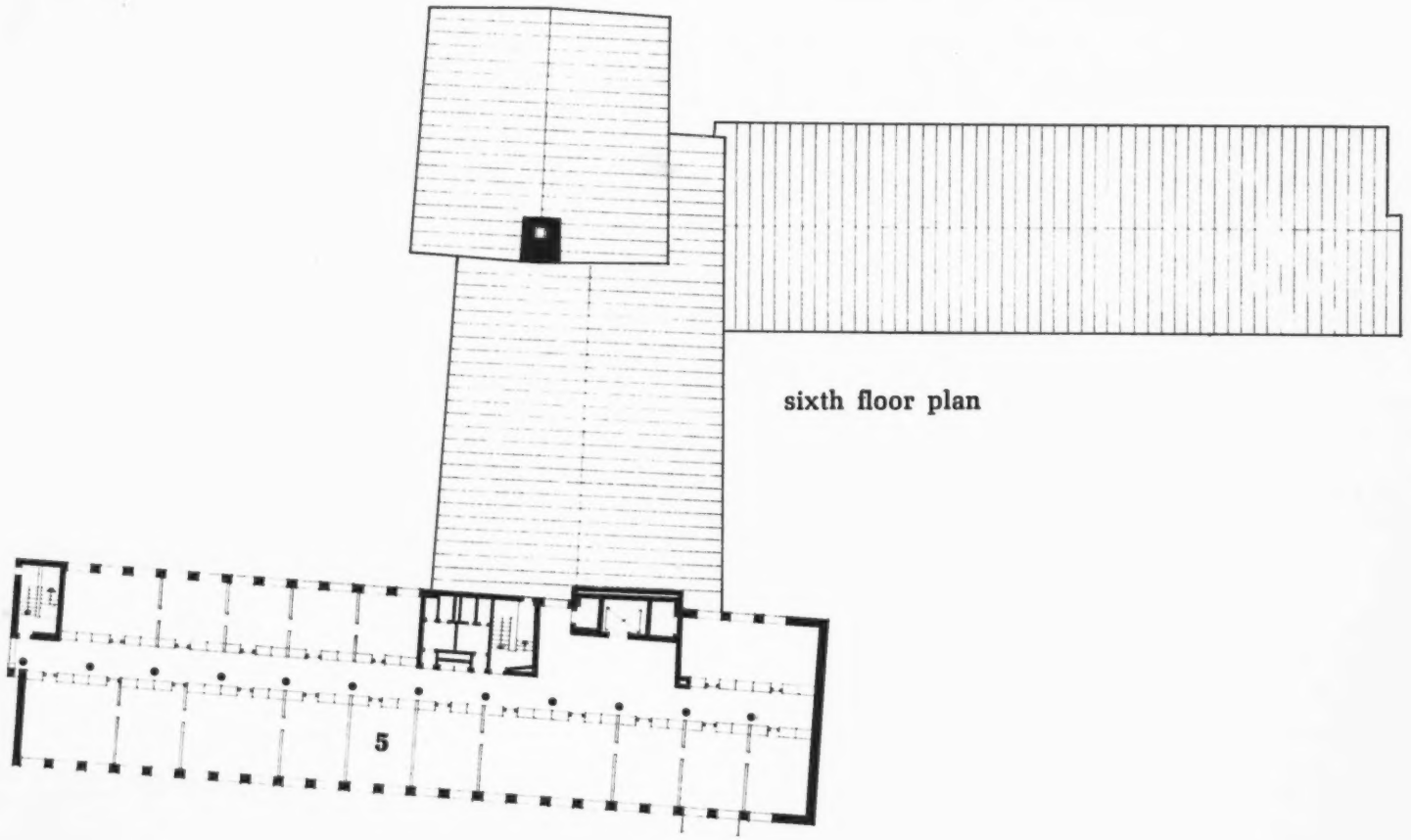
Photographer: Robert C. Deigert



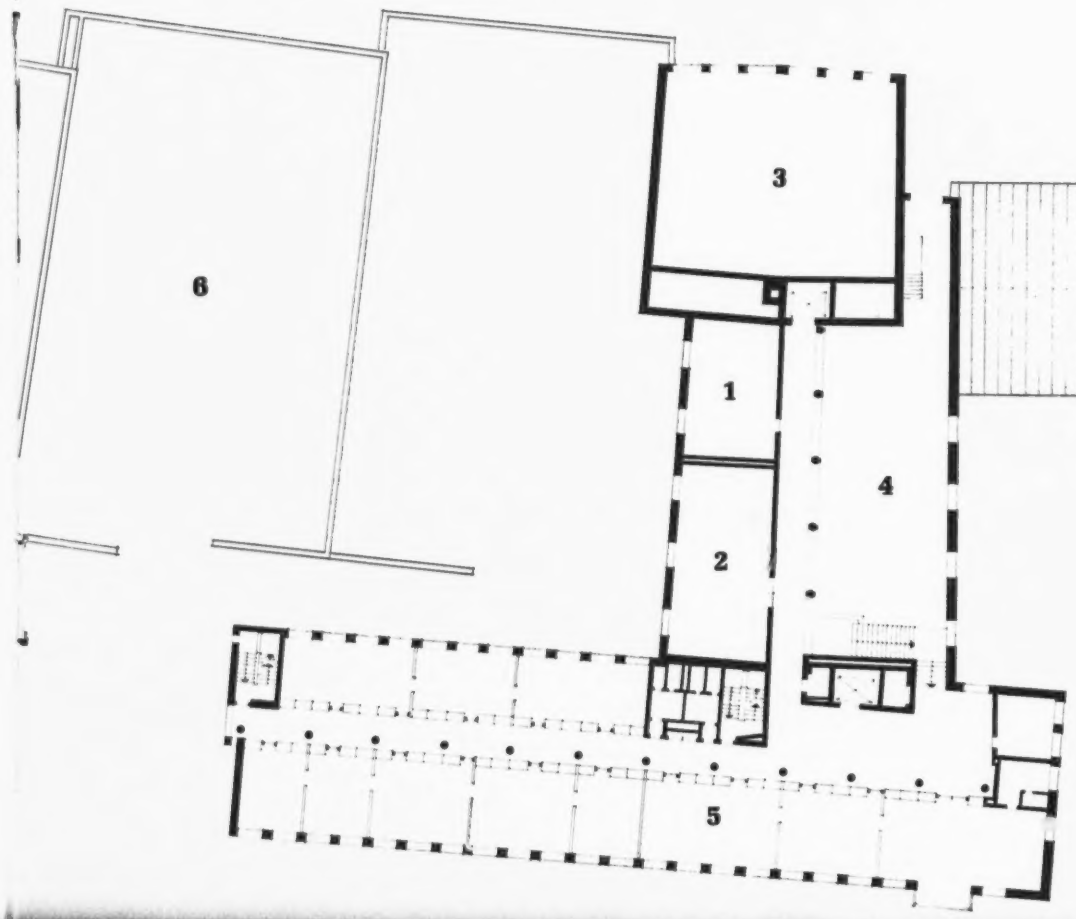
fourth floor plan

legend
1. parking garage—protected space
2. parking on roof of lower garage
3. main hall
4. auditorium
5. cafeteria
6. offices





sixth floor plan



fifth floor plan

legend
1. library
2. conference
3. upper auditorium
4. upper main hall
5. offices
6. parking on roofs of lower garages

Award of Merit

Watsonville City Hall
Watsonville, California

Owner: City of Watsonville
Thomas J. Rowan, City Manager

Architect: Robert B. Wong, AIA
Donald Sandy, Jr., William W. Hedley, Jr., AIA
Associated Architects, San Francisco, California

Structural Engineers: Rutherford and Chekene
San Francisco, California

Fallout Shelter Analyst: William W. Hedley, Jr., AIA

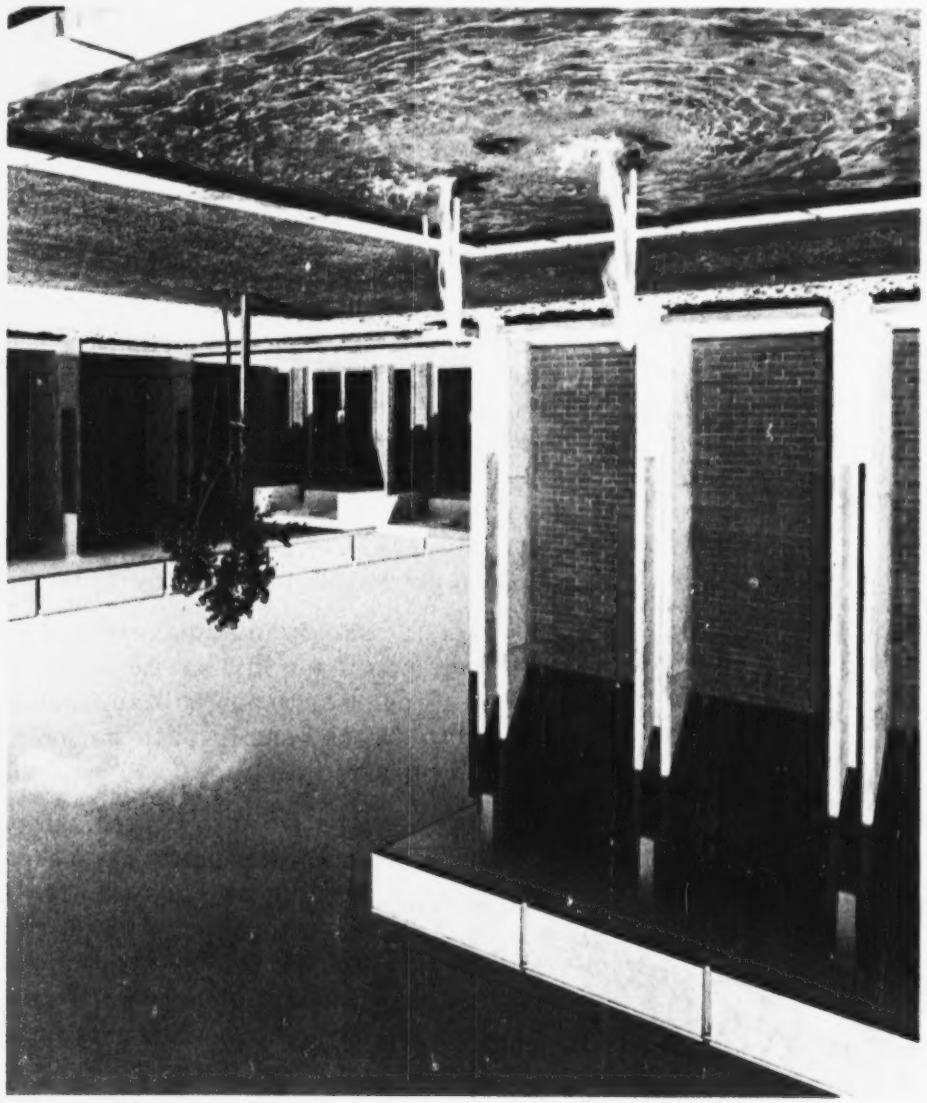
Jury Comment

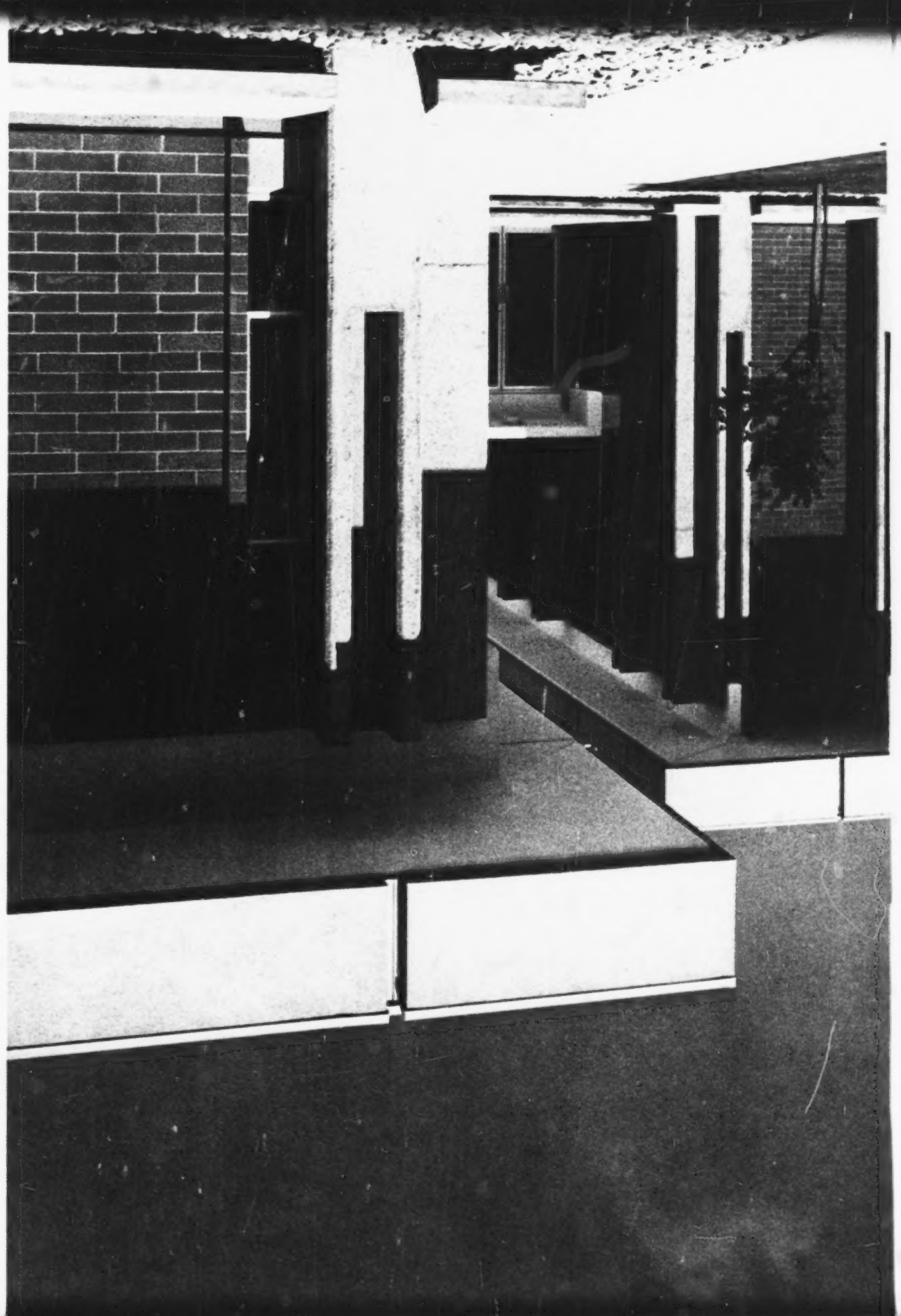
This well-organized plan clearly expresses its two major functions. Interior circulation and spaces are well handled. The small garden courts add greatly to the quality of the office areas. There is a pleasing relationship between the two building masses and careful design of exterior elements gives this important building an appropriate scale and character.

Architect's Statement

The design of this city hall and council chamber building sought built-in flexibility and expansion to house all city offices. The civic building was to be "sympathetic" with older neoclassic buildings in the surrounding downtown area. Due to the separation of functions, the council chamber had to be isolated from the main administration wing, and the possible future development of the civic center toward Union Street had to be considered. An Emergency Operating Center, providing the necessary facilities for housing personnel during an emergency, was to be incorporated in the city hall at minimum cost.

The council chamber, which has a distinctly separate use from the administrative offices, was made the focal point of the project to serve as a reminder of the importance of government through elected representatives. The high proportions of the council chamber in relation to the height of the office wing give added





emphasis to this concept. Placing the entrance lobby between the two elements enables the lobby to serve both the administrative offices, which are used primarily during the day, and the council chamber, which is principally occupied during evening hours. Dual entrances are provided from Main Street and the prospective civic center development toward Union Street.

Since many of the buildings in the central business district near the city hall have deeply recessed windows and columnar facades, the deep concrete columns and masonry panels on the city hall reflect the character of the existing buildings.

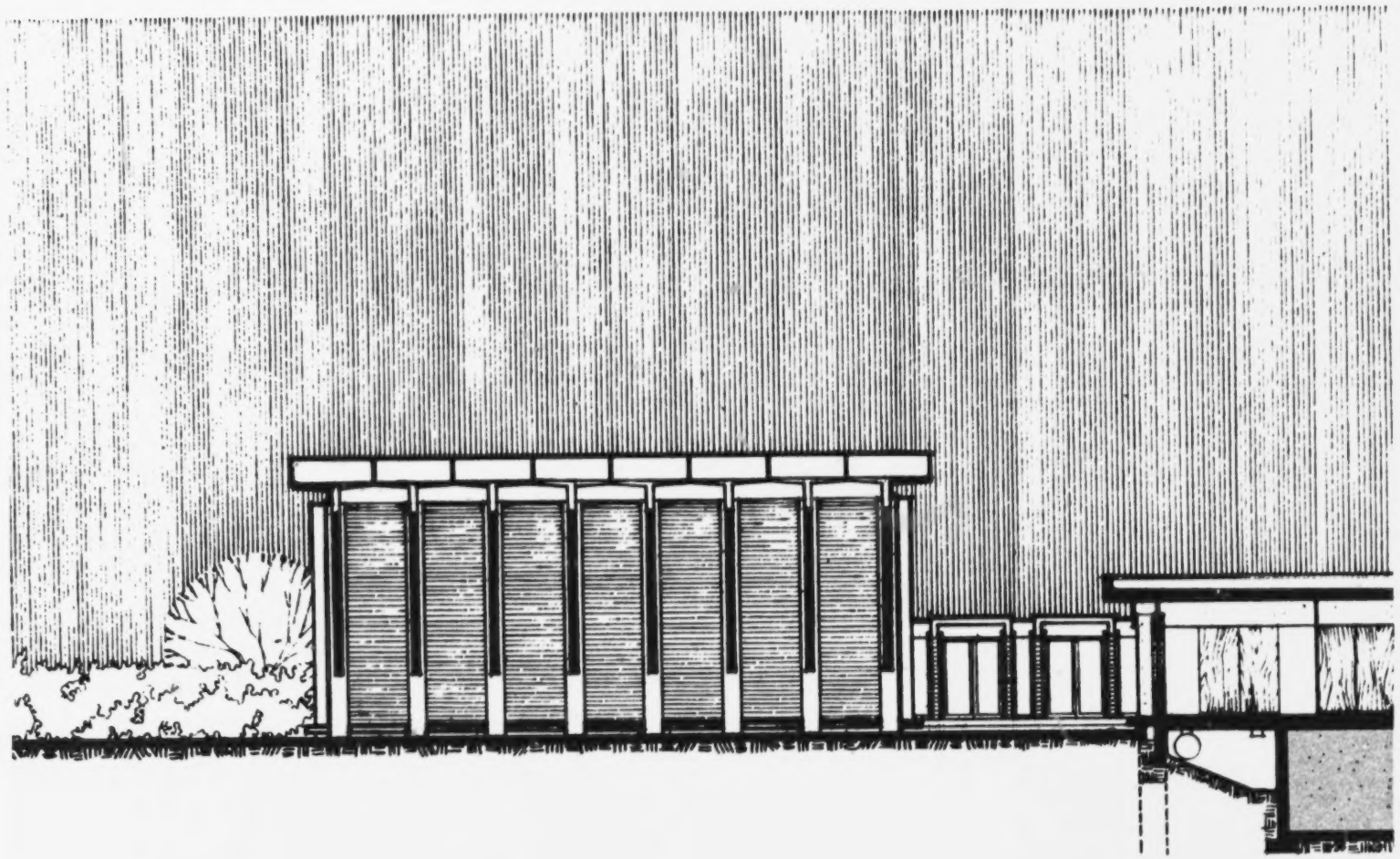
Prestressed concrete roof tee-beams set on columns provide 84 feet of clear, uninterrupted interiors. In combination with the cellular steel deck floor and movable partitions, this allows great flexibility in rearranging areas. As an additional aid to making the main floor completely flexible, the basement area is encircled by a utility trench which allows access for new utilities or relocation of existing utilities into any portion of the building. Cost of foundation work was reduced through "berming" between the grade beams and the basement walls.

The basement area of the city hall serves as the Emergency Operating Center as well as providing space for day-to-day functions. Normal daily use spaces in this area include an employees' lounge, squad room for the adjacent police station, offices for the Visiting Nurses Association and meeting rooms.

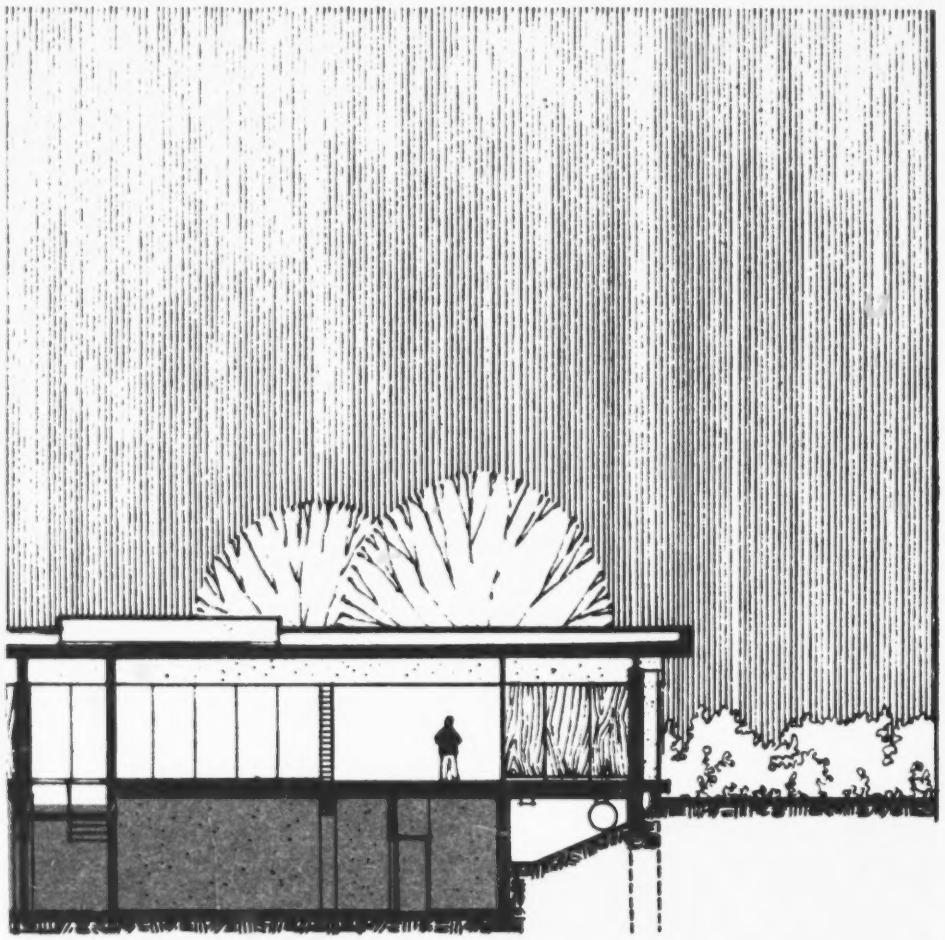
Shelter Analyst's Remarks

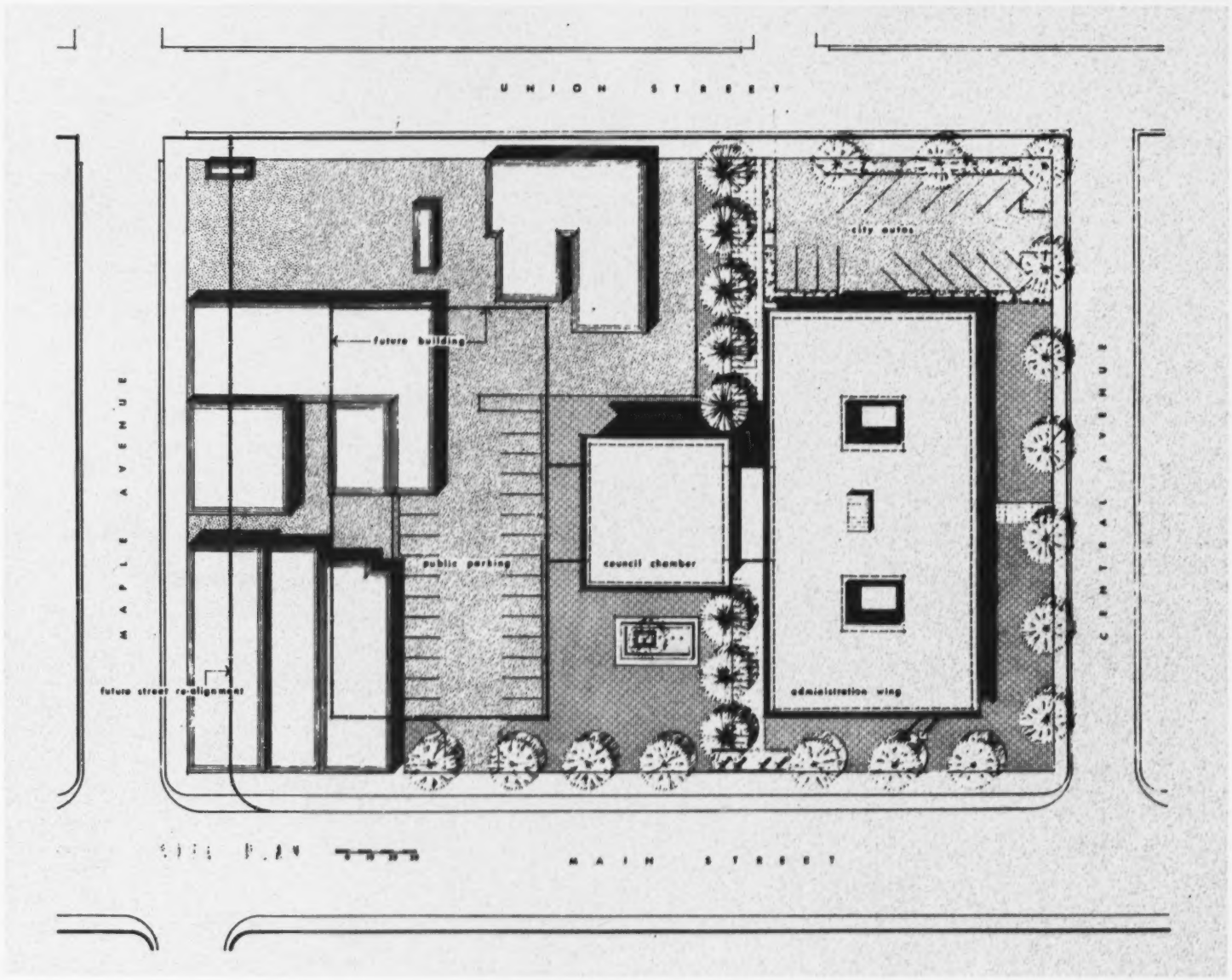
Only minor design considerations beyond those for the normal use of space were required to give the Emergency Operating Center portion of this building a Protection Factor of 100.

The prestressed concrete roof tees (with 8-inch stems), the cellular steel deck flooring and the concrete topping provided the major portion of the mass required. Only a change in concrete from lightweight to standard aggregate and an increase of 1½ inches in topping thickness were necessary to provide the



section

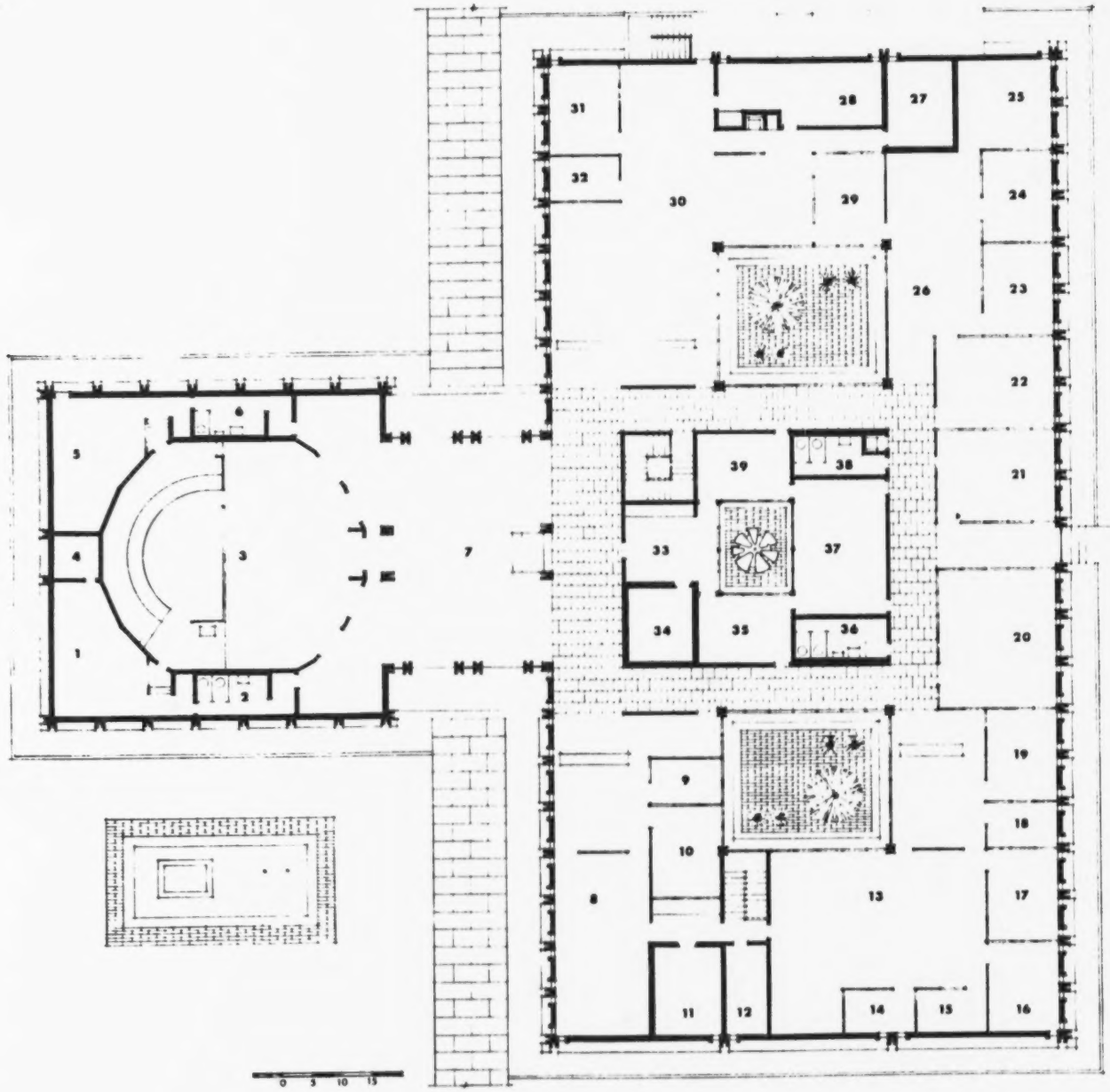



UNION STREET
future building
city autos
MAPLE AVENUE
public parking
council chamber
CENTRAL AVENUE
future street re-alignment
administration wing
MAIN STREET

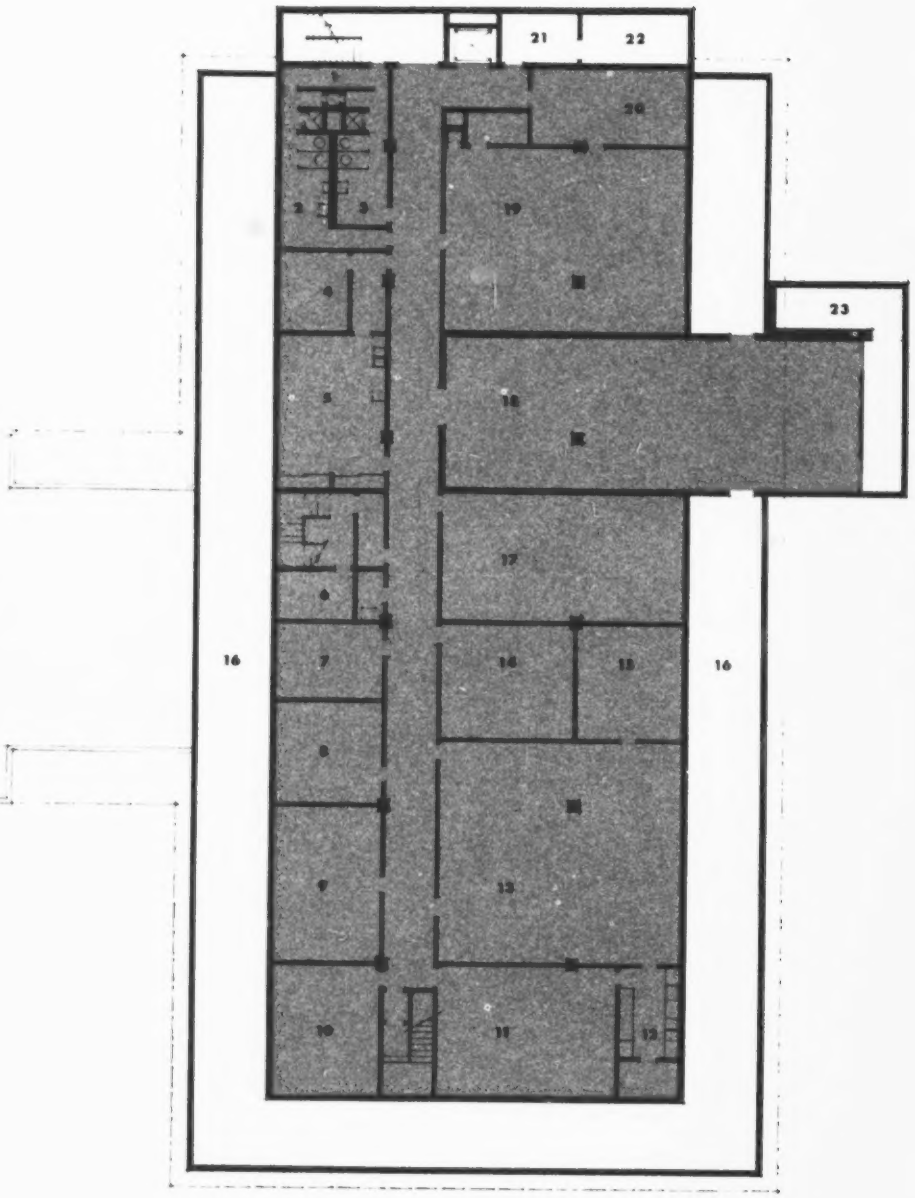
site plan

minimum protection factor. The floors of the interior garden courts in the administrative wing were of flat-plate concrete construction 10 inches thick with 2-inch brick paver finish.

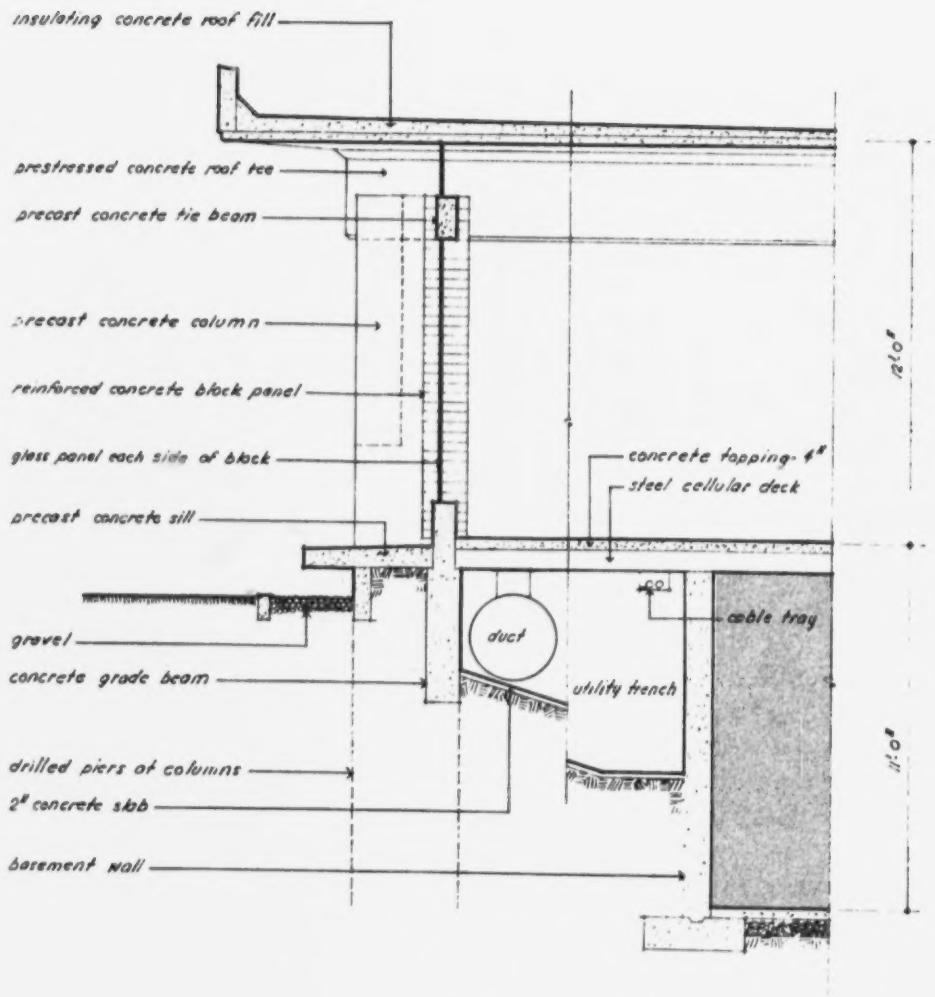
In the protection analysis, the detector was placed off-center in the basement of the building to determine the minimum PF available.



first floor plan



basement plan



detail section

Award of Merit

Lenihan High School
Marshalltown, Iowa

Owner: Rev. William E. Clark, Principal

Architect and Engineer:
Donald P. McGinn Associates, Dubuque, Iowa

Fallout Shelter Analyst: Donald P. McGinn, AIA

Jury Comment

This building is distinguished by a strong functional organization of major elements expressed clearly on the exterior. The interior court will be a handsome visual focal point when landscaped and will make walking through surrounding corridors and cafeteria a delightful experience.

The design of the Music Department area, which doubles as a fallout shelter, is imaginative. Treatment of the floor and handsome structural ceiling gives this room a strong identity and interest.

Architect's Statement

The Lenihan High School Corporation directed us to design a new high school and plan the surrounding campus so that it would inspire scholarship coupled with spiritual and physical growth, stimulate cultural and aesthetic development, and serve as a background for the social development of its students. Lenihan High School is a general four-year high school. The service facilities, instructional materials center, laboratories, offices, sanitary facilities, cafeteria, gymnasium, and other single-unit service areas were designed to take care of the expected ultimate student enrollment of 500. The classroom space was limited to an area sufficient for 300 with the understanding that future classrooms could be constructed according to a master plan.

The academic area of the school is divided into four "houses" to separate the students into small working groups. One house contains the Freshman and Sophomore home rooms and a science laboratory. Another unit houses the Junior and Senior home rooms and a

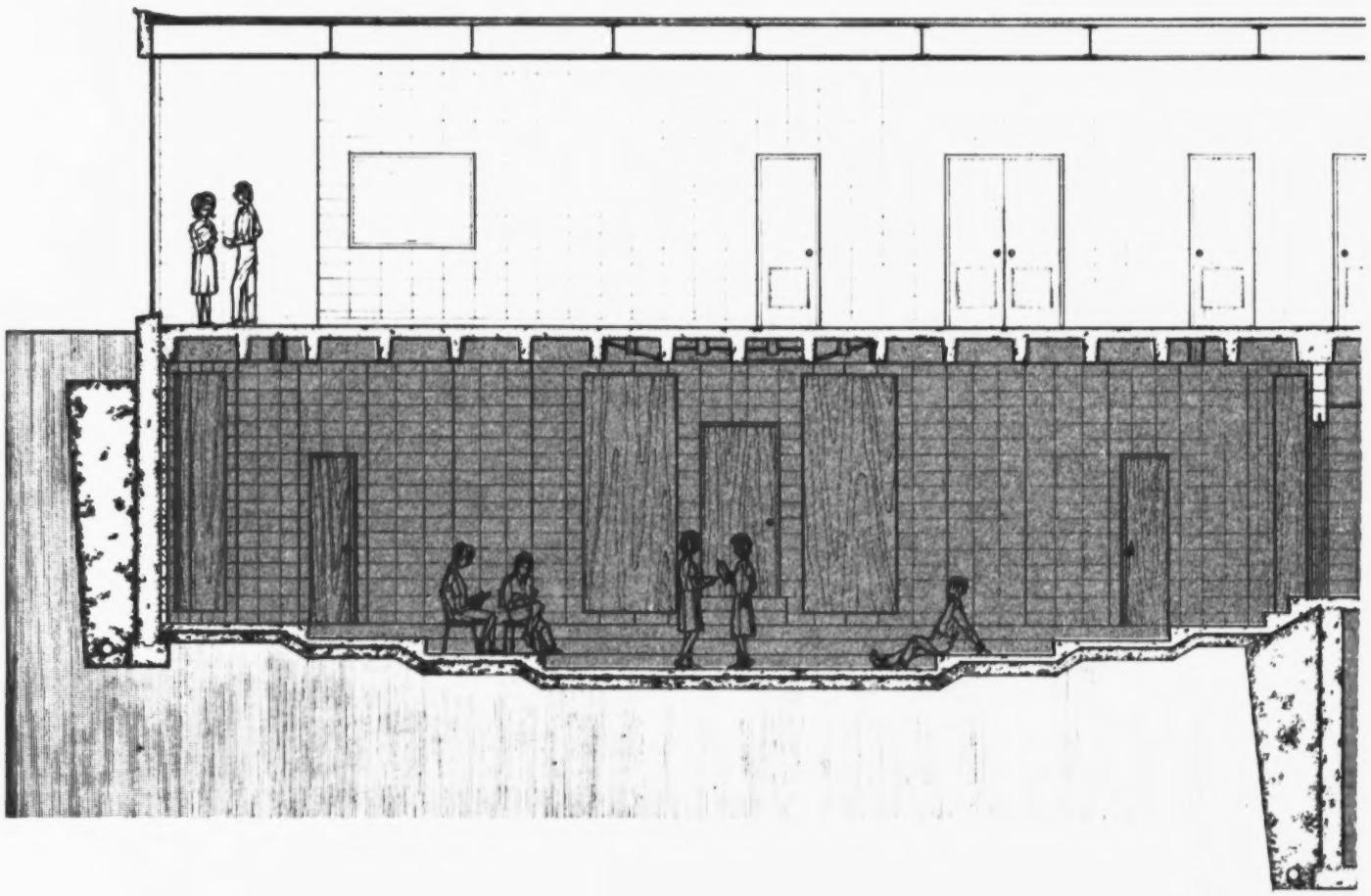
science laboratory. Each of these units has its own lockers, rest rooms, and a small conference room. The third unit contains the home economics department, the business education department, and the industrial art shop.

Corridors connecting the houses and other portions of the school border exterior courtyards and provide pleasant views for the students moving from one area to another within the building. Windows in individual areas are kept to a minimum. The library and administrative unit is located at the center of the plan, with a chapel on the axis of the student entrance. The chapel is expressed in elevation by a raised roof line which continues over the main entrance.

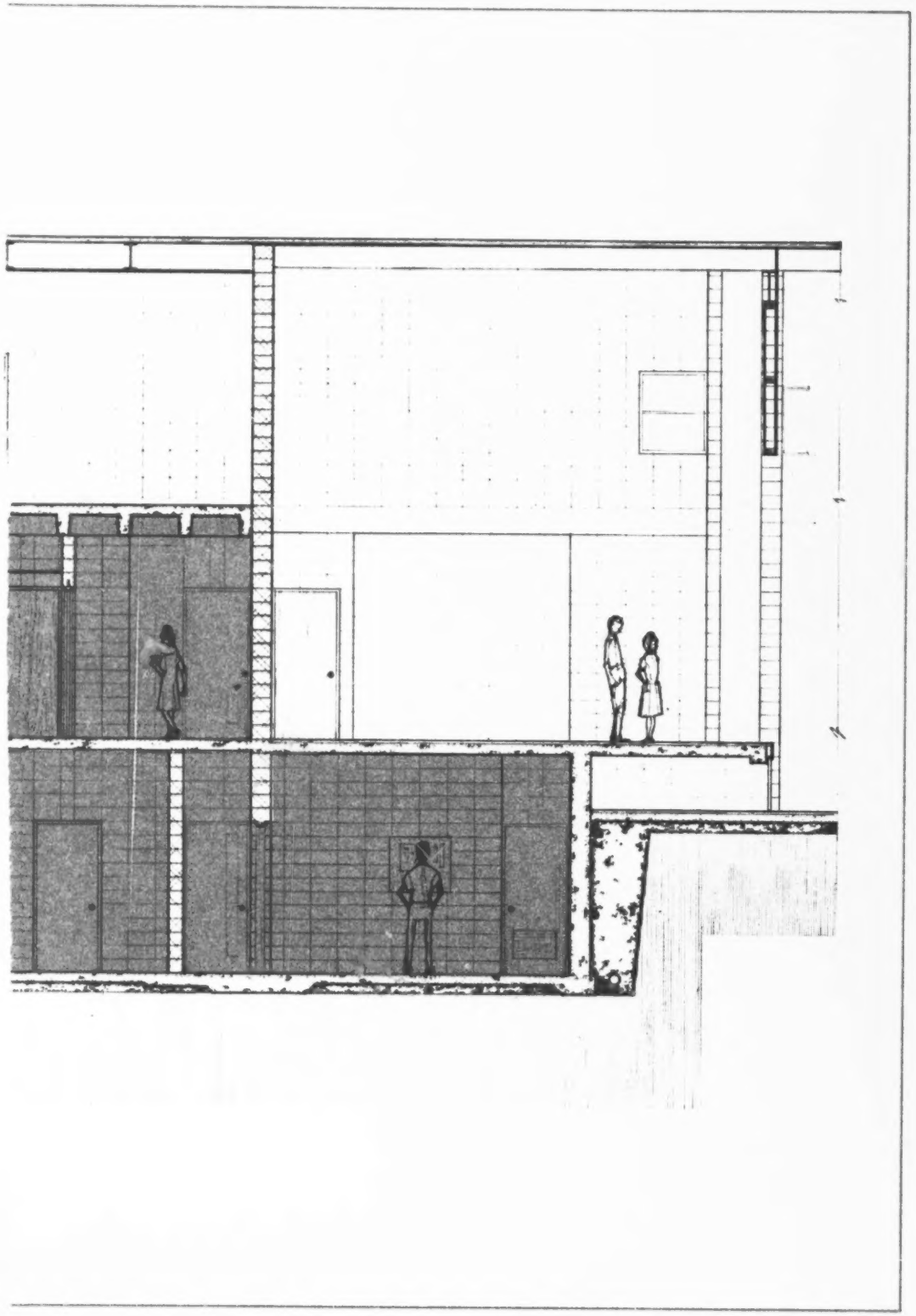
All noise-producing activities, such as the gymnasium, locker rooms, cafeteria, and music departments, are separated from the classroom units by a landscaped court. The cafeteria can seat 175 students and double as a social hall. The music department is located below the cafeteria. Its main room, the oval-shaped rehearsal room, has permanent concrete risers ascending from the center and serves as a choral-band rehearsal hall, a speech-debate arena, a theater-in-the-round, and a fallout shelter. Adjacent to this large room is a series of small rooms to serve as offices, music practice rooms, and girls' locker rooms. These rooms have dual purpose as theater dressing rooms, decontamination rooms, and storage rooms.

The gymnasium is located at the end of the building where the elevation of the site is lowest and access from the parking lot most convenient. In addition to athletic programs, the gymnasium can be used for large assemblies and public presentations such as concerts. The stage for these presentations is at the same elevation as the adjacent music rooms.

The building is designed to follow the natural slope of the site. Floor elevations of the academic units vary, and changes between units are achieved by corridor ramps. The change in level from the cafeteria to the



view of gymnasium entrance



theater—shelter

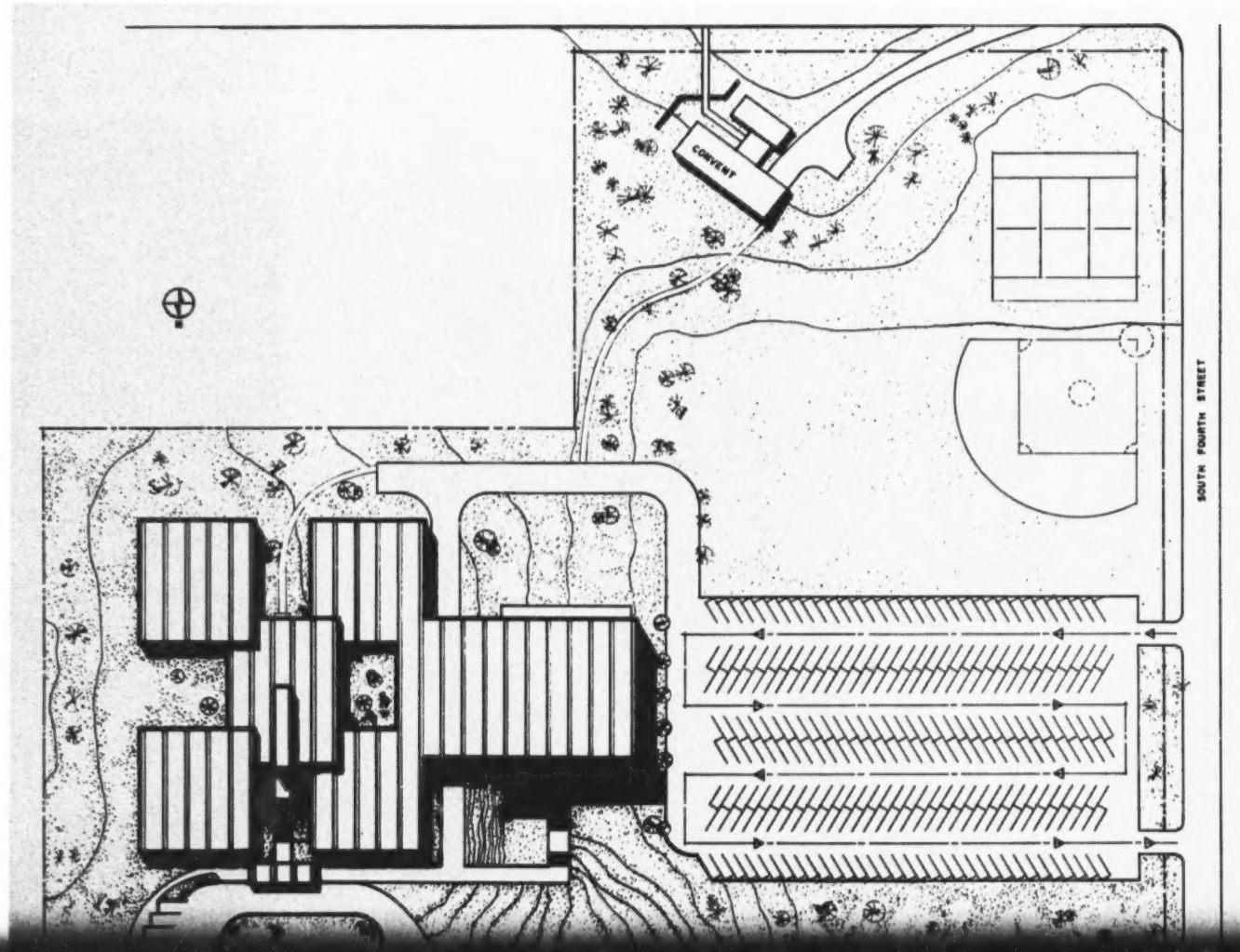
gymnasium is made through interior stairs. Following the natural slope of the site allowed a simple massing of the building. The roof line of the academic unit at the lowest level elevation was continued over the cafeteria, stage and gymnasium without interruption.

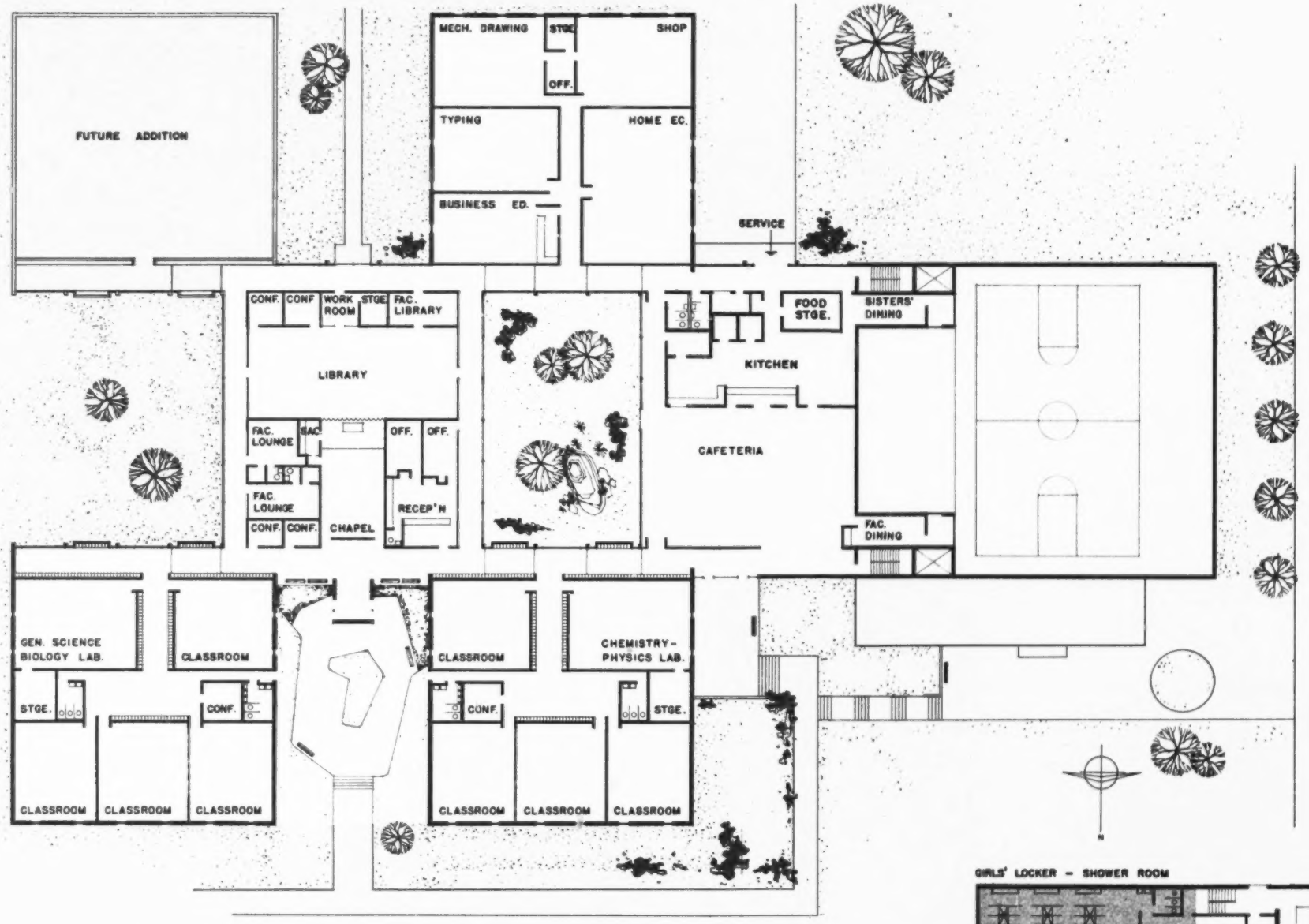
Shelter Analyst's Remarks

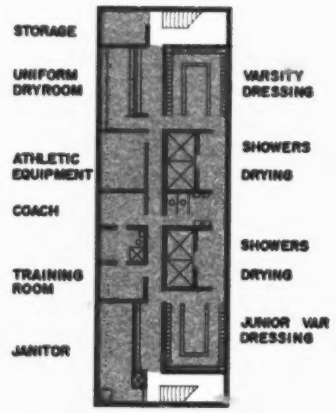
A fallout shelter was desired in this building initially as a protection for the occupants and citizens of the area. The structural system selected for the roof was not adequate to provide a Protection Factor of 40. Therefore, it became evident that the most reasonable area for shelter would be partially under ground. Following the natural slope of the site and placing the music department where it would be convenient to the stage and gymnasium without disturbing the quiet areas of the building made it the most natural dual-purpose area. Protection from the roof contribution was achieved by using a 6-inch thick concrete floor slab with 10-inch deep, 6-inch wide ribs 3 feet on centers each way. This system weighed an average of 96 pounds per square foot. Structurally, it allowed a room with a 40-foot diameter to be free of interior supports. The contribution from roofs of adjacent buildings was kept to a minimum by the necessary interior partitions, as was the ground contribution from the open side. Earth fills provide protection around the shelter on the three remaining sides.

In summary, the roof contribution of this building is twice the value of the ground contribution. The heavy concrete waffle slab system provides adequate protection. This dual-purpose fallout shelter has a PF 46. It is ventilated through the heating and air-conditioning system and, based on 10 square feet per person, will shelter 585 people.

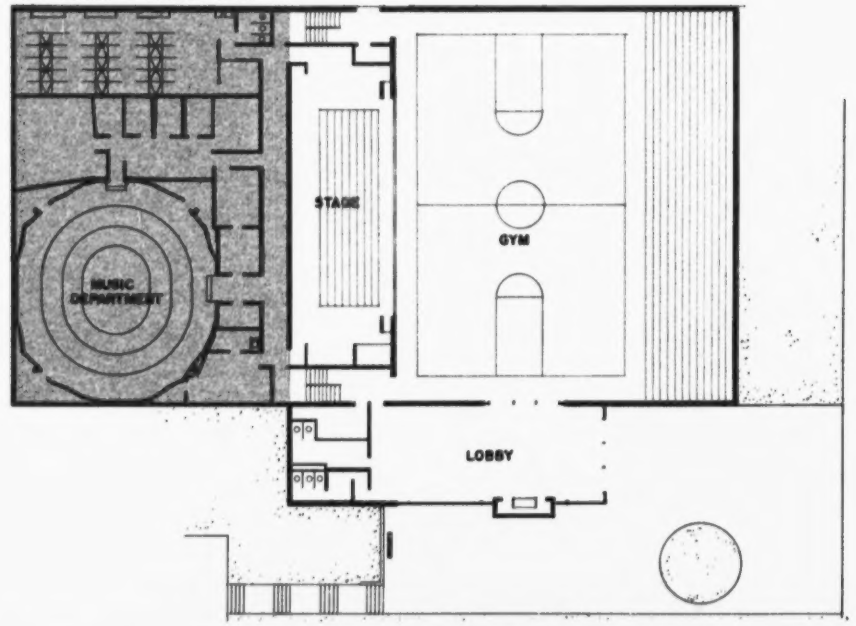
Photographer: Julius Shulman, Los Angeles, California







GIRLS' LOCKER – SHOWER ROOM



Award of Merit

St. Lukes Hospital Addition
Fargo, North Dakota

Owner: St. Lukes Hospital Association, Inc.

Architect & Engineer: Foss, Engelstad & Foss
Fargo, North Dakota

Fallout Shelter Analyst: Mark B. Foss, P.E.

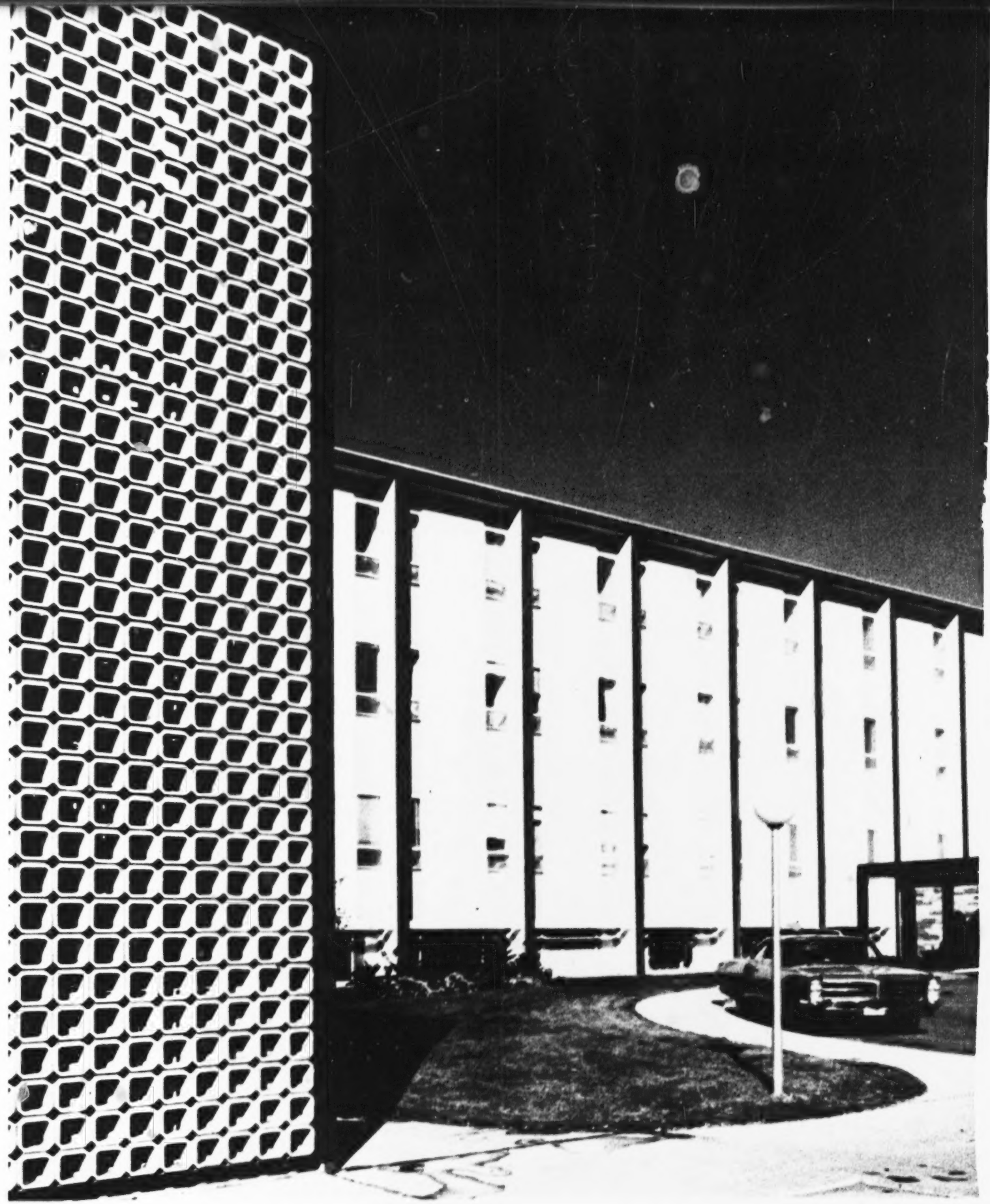
Jury Comment

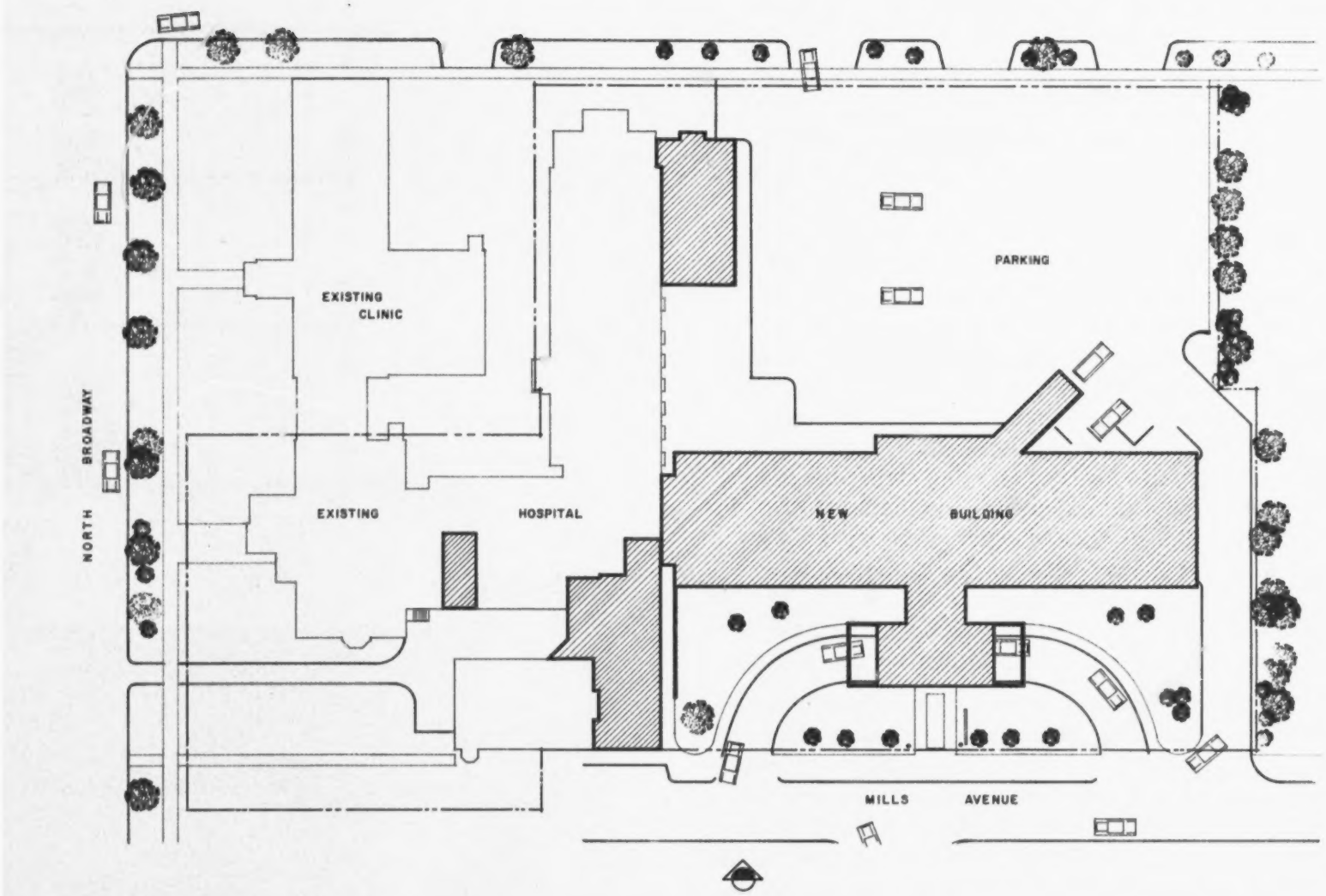
This addition is considered to be a well organized solution to a complex problem. The plan of the addition is straight-forward and works well with the older building. Detailing is clean and competent, and important interior spaces are pleasant. The Jury noted the lack of rapport between the old and new elements of the building.

Architect's Statement

The basic design problem in the planning of the 63-bed hospital addition was connecting it to the existing hospital so that functions in both would be correctly related for all the various medical care facilities. Other design requirements including matching the floor heights of the existing hospital and structurally designing the new addition for three more future floors above. Also, the addition was to have circulation features to serve a future neuropsychiatric institute wing addition to the north off the middle corridor and elevator lobby. Finally, the new addition design had to overcome the aesthetically poor features of the existing boiler and laundry building located where the new hospital addition connected to the existing hospital.

The exterior facade of the new addition contrasts sharply with the drab features of the existing red brick hospital. It is of reinforced concrete frame with exterior walls of exposed aggregate concrete panels between aluminum-framed windows located on each side of the exposed concrete columns. The columns protrude 2 feet from the face of the building and accentuate the vertical lines of the building.




EXISTING
CLINIC
EXISTING
HOSPITAL
NORTH
BROADWAY
PARKING
NEW
BUILDING
MILLS
AVENUE

site plan

The existing boiler and laundry building was remodeled and screened by a two-story, concrete-framed, screen-wall with clay tile fillers painted white.

The ground floor was set 4 feet below grade so the administrative area, including reception and admitting facilities and main lobby, could be on the lowest level of the hospital addition, thus avoiding interference with patient traffic from the existing hospital to the new addition (on upper levels).

Shelter Analyst's Remarks

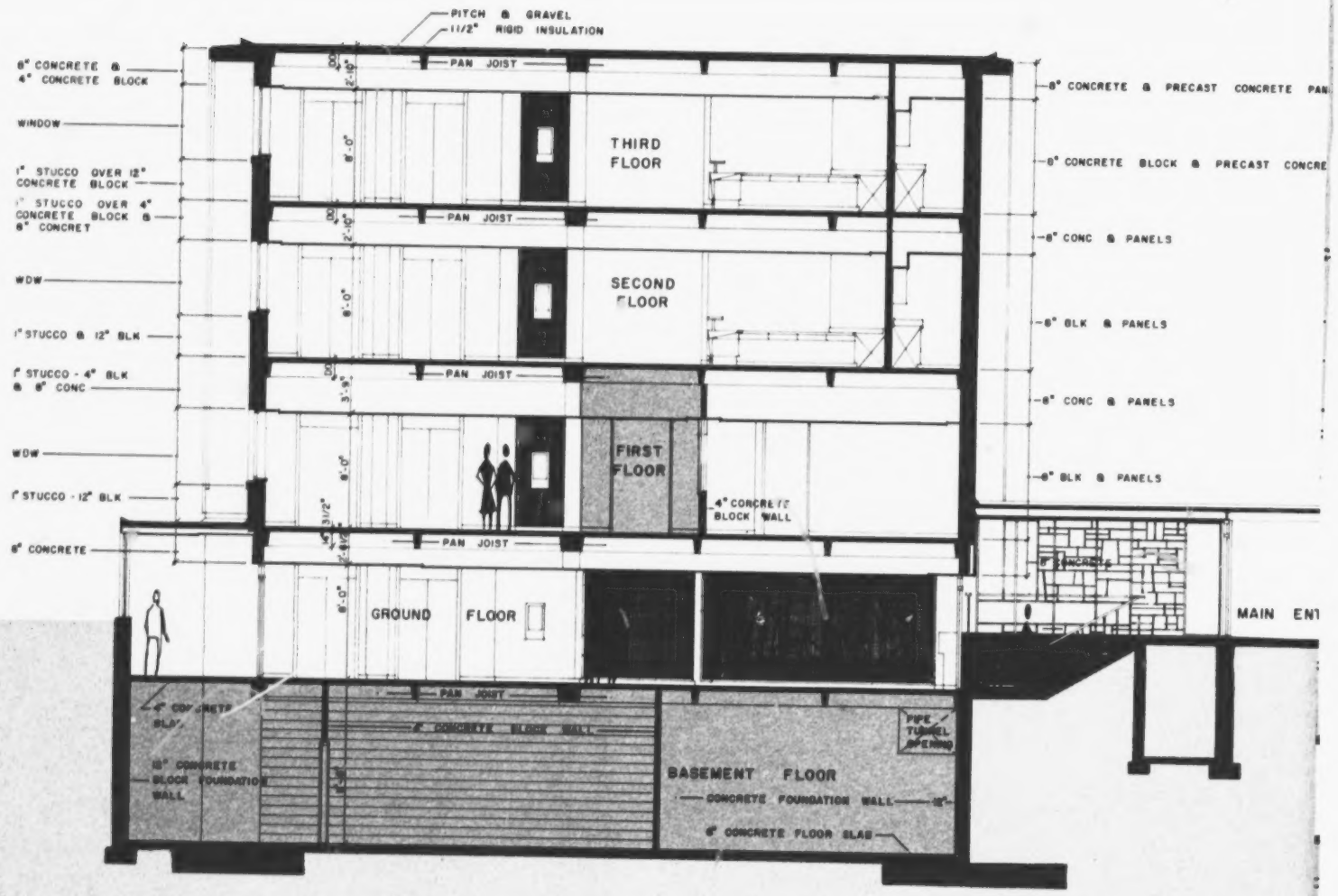
The two dual-use fallout shelters incorporated in this hospital addition were achieved rather easily because the required functional planning dictated a subbasement for the large mechanical room and the long corridor (interior core area) separating patient-room wings. Also, structural and fire code requirements necessitated a reinforced concrete frame, and this system, coupled with the exposed aggregate concrete panel facade on a concrete block backup, provided a mass thickness which enhanced protection from gamma radiation in the shelter area.

The concrete pan-joist floor and roof slabs over the mechanical room-fallout shelter cumulatively provide a most effective overhead barrier resulting in a Protection Factor of over 1000 for this dual-purpose shelter. Also, the floor level of the shelter is 15 feet below grade and provides excellent geometric shielding since the shelter is out of the direct path of radiation.

The first-floor interior core area shelter (patient-wing corridor as dual use) has a good overhead barrier (three pan-joist slabs), but the two-wall barrier shielding on each side (exterior concrete and masonry wall and interior concrete block partition) is offset by the 25% apertures (two exterior windows and one patient door). However, these apertures were necessary for the hospital design. Thus, the resulting protection factor for this shelter area is 50.

Shelter was inherent in the design of the building and did not increase construction costs.

Photographer: Joel, Sioux Falls, South Dakota



section

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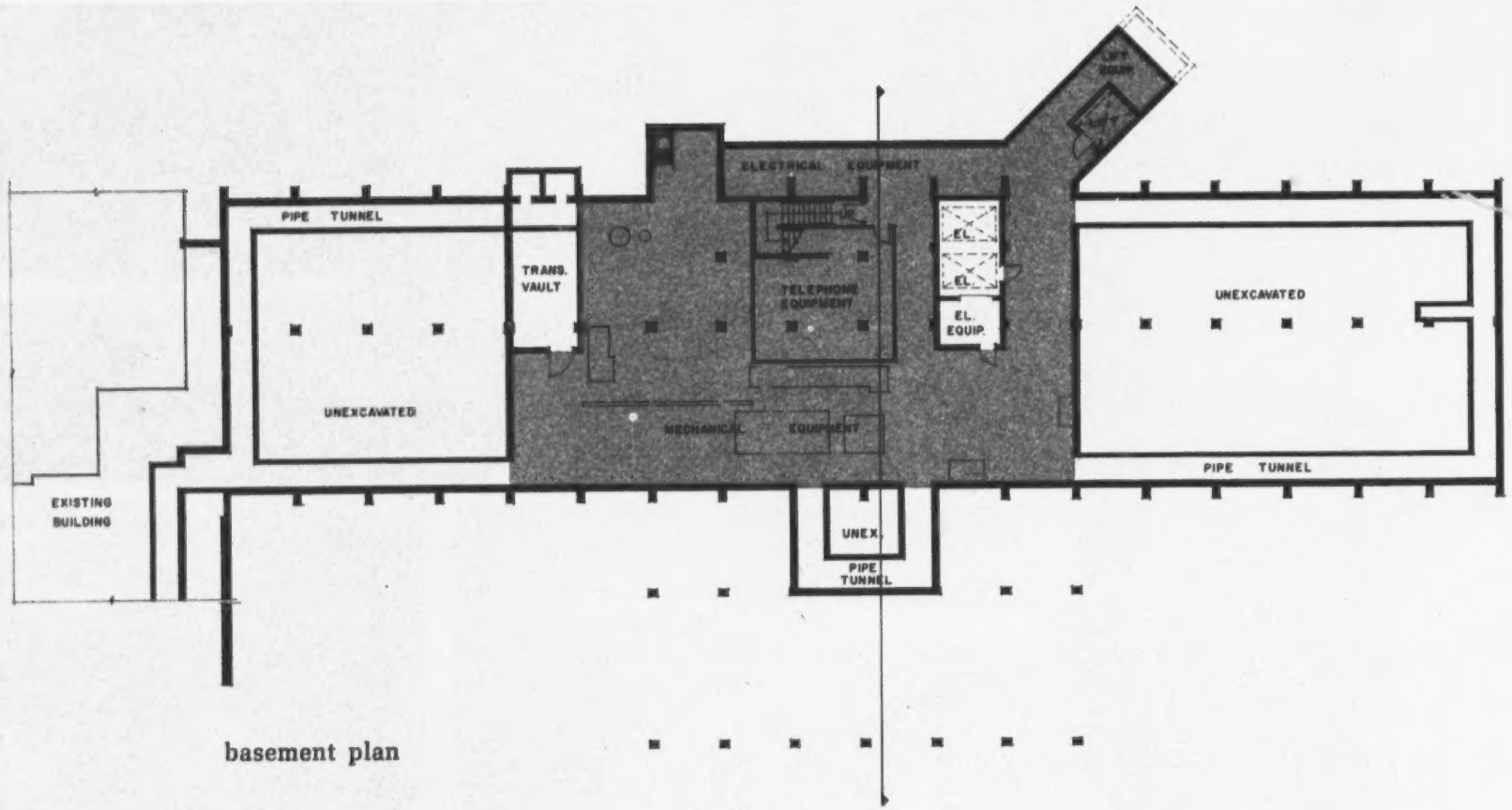
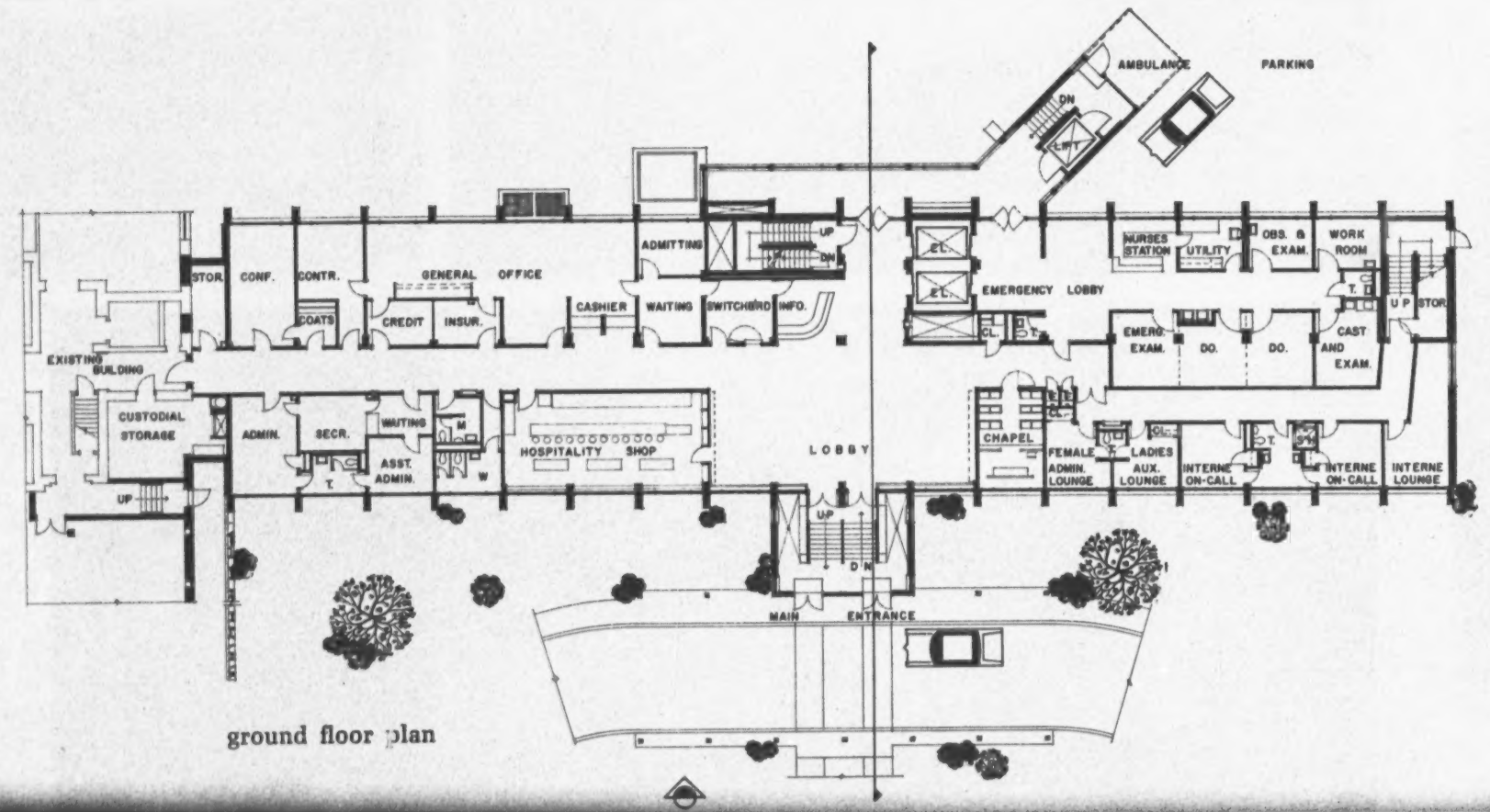
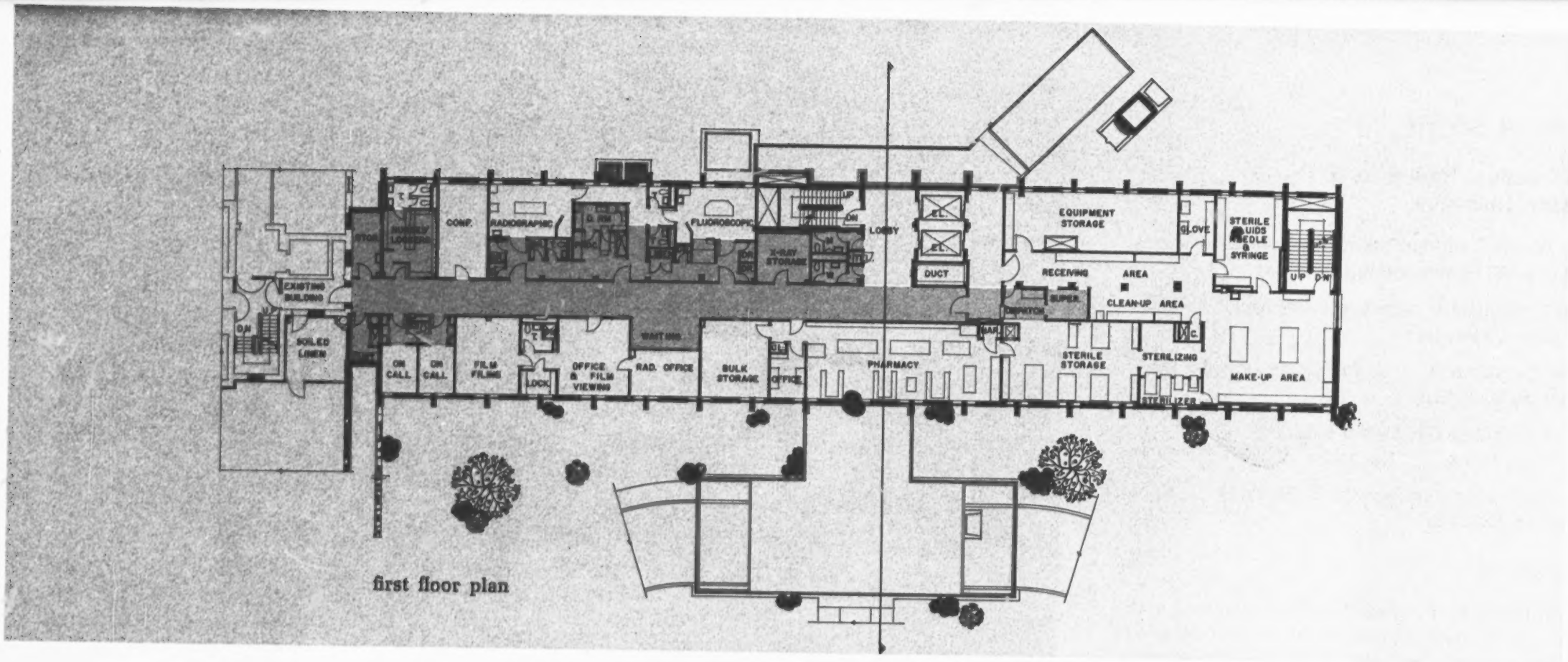


basement plan



ground floor plan



first floor plan

Award of Merit

Alexis I. duPont High School
Greenville, Delaware

Owner: Alexis I. duPont Special School District
Dr. Thomas W. Howie, Superintendent

Architect: Whiteside, Moeckel & Carbonell
Wilmington, Delaware

Engineer (Structural): L. H. Doane Associates, Inc.
Wilmington, Delaware

Engineer (Mechanical): Ewald & Miller
Philadelphia, Pennsylvania

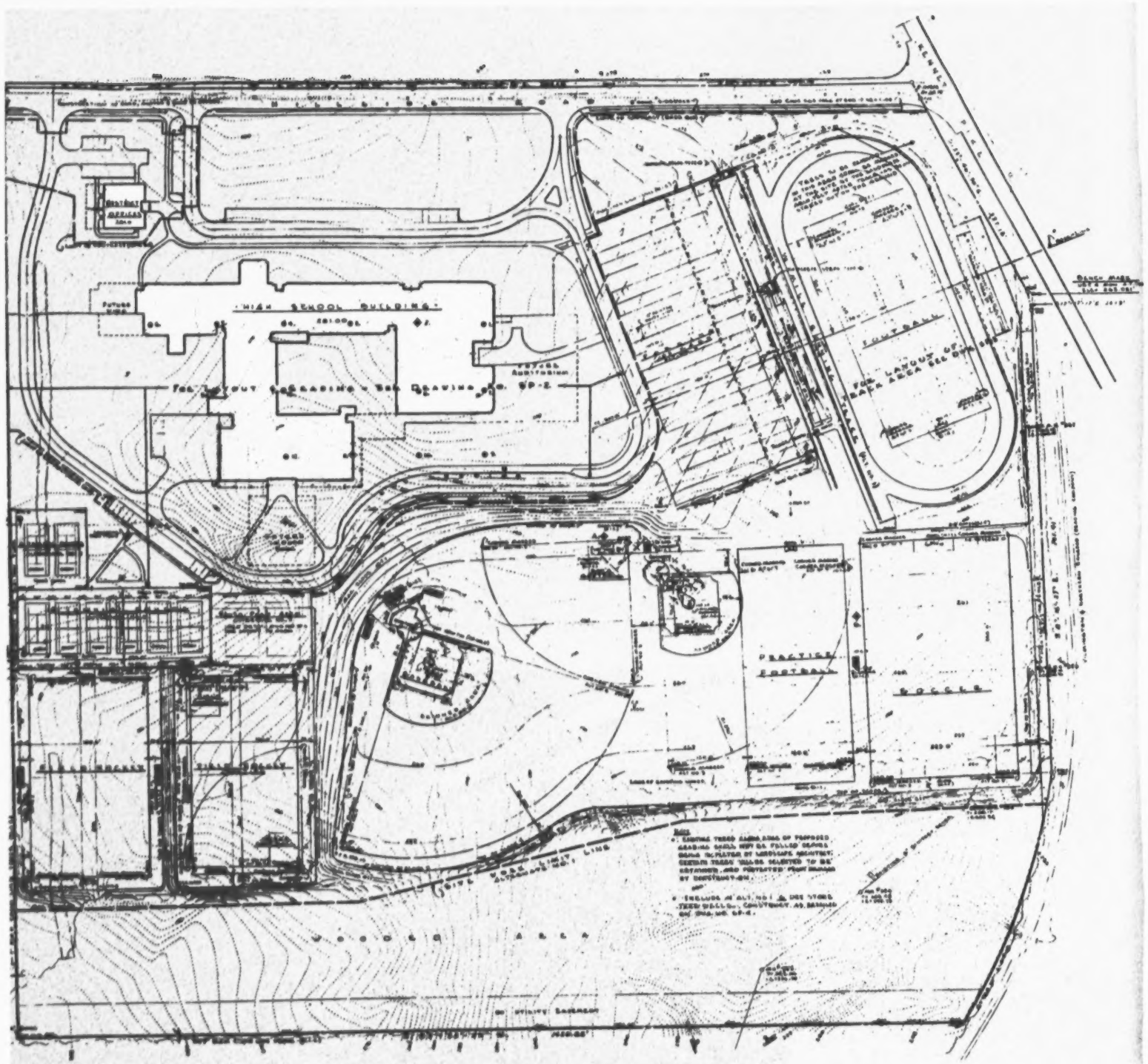
Fallout Shelter Analyst: Joseph E. Plotts, Jr.
Wilmington, Delaware

Jury Comment

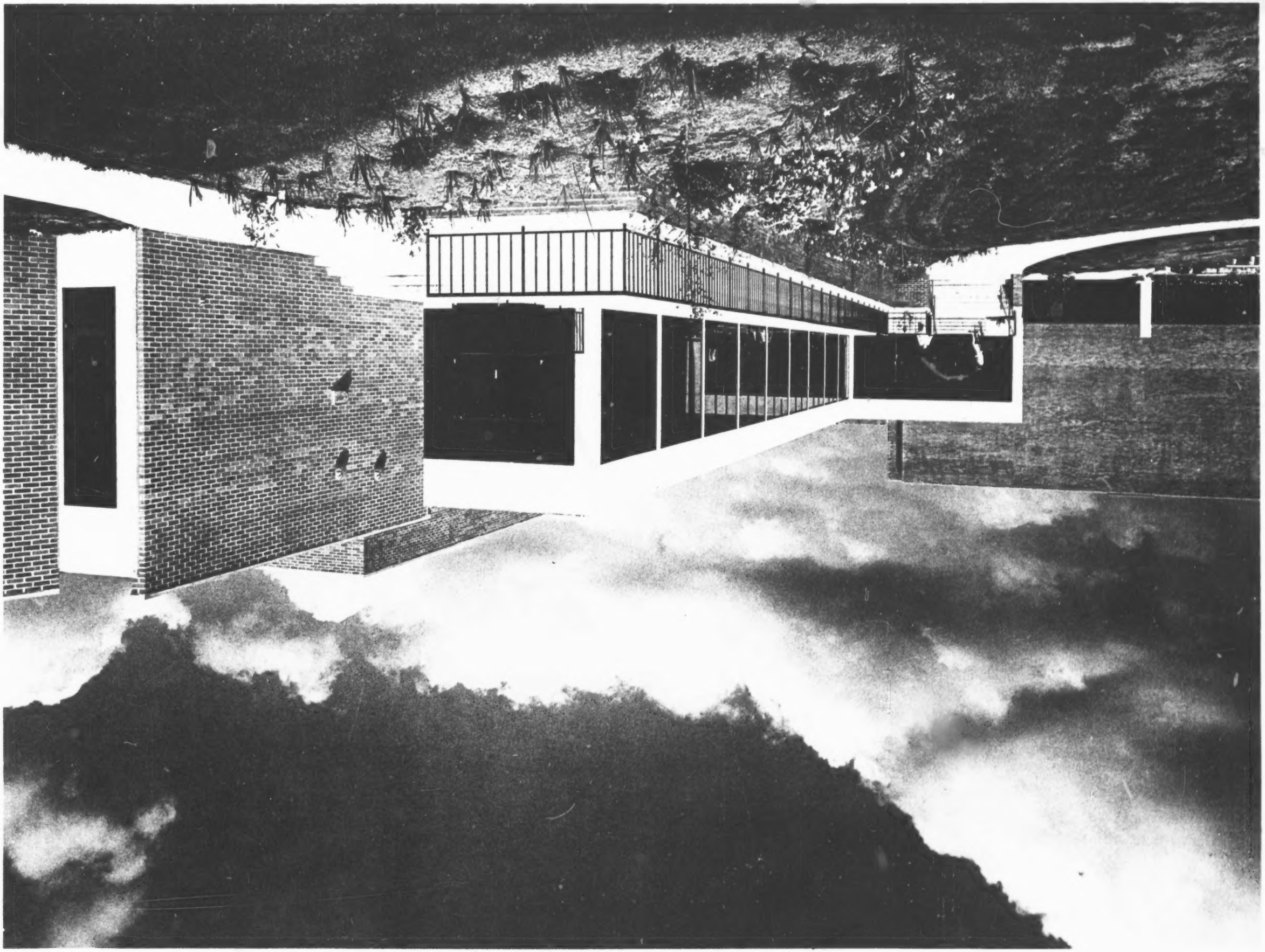
The repetitive use of bay-shaped wall elements and recessed windows, combined with a restrained use of materials, serves to unify this large complex building.

Architect's Statement

The building program for this 1200 student high school was established in 1962. It was designed around the K-4-4-4 system to provide an intensive academic program from which 75 to 80 percent of the students will go on to higher education. The school uses large-group instruction augmented by standard classrooms and seminar areas. A large instructional materials center houses library books, all types of instructional materials and machines in three resource centers (living arts, mathematics-science and humanities). The science program includes individual project areas for advanced students, an observatory, and a greenhouse, in addition to fully equipped laboratories, including a radioisotope laboratory. Music, art, shops, a teaching auditorium, and extensive physical education facilities are also provided. A large auditorium, a swimming pool and additional classrooms are planned for future expansion.
As the program developed, the question of including fallout protection throughout the school district was



site plan



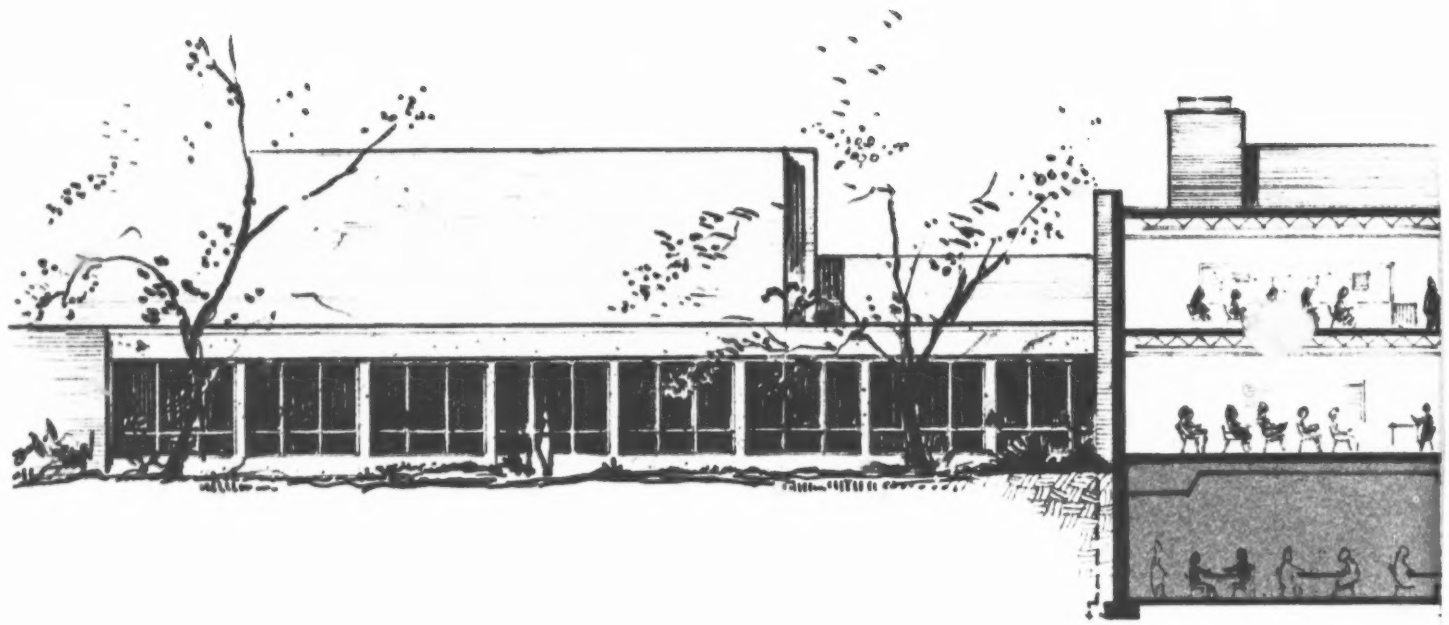
the subject of intensive investigation and discussion. The question was decided at the polls and formally adopted by a public referendum in late 1965.

The architect made a series of studies to determine the best means of providing the fallout capability. It was decided to provide a shelter area large enough for the entire student-faculty population of the school and to meet the standards of the Office of Civil Defense. The cafeteria complex, graphic arts laboratory and student council rooms were located below grade in the three-story section of the school to obtain dual use of these areas for shelter. By utilization of terrain shielding, and a modest thickening of the first floor slab, a protection factor in excess of 100 was obtained. This is greater than the OCD standard of PF 40.

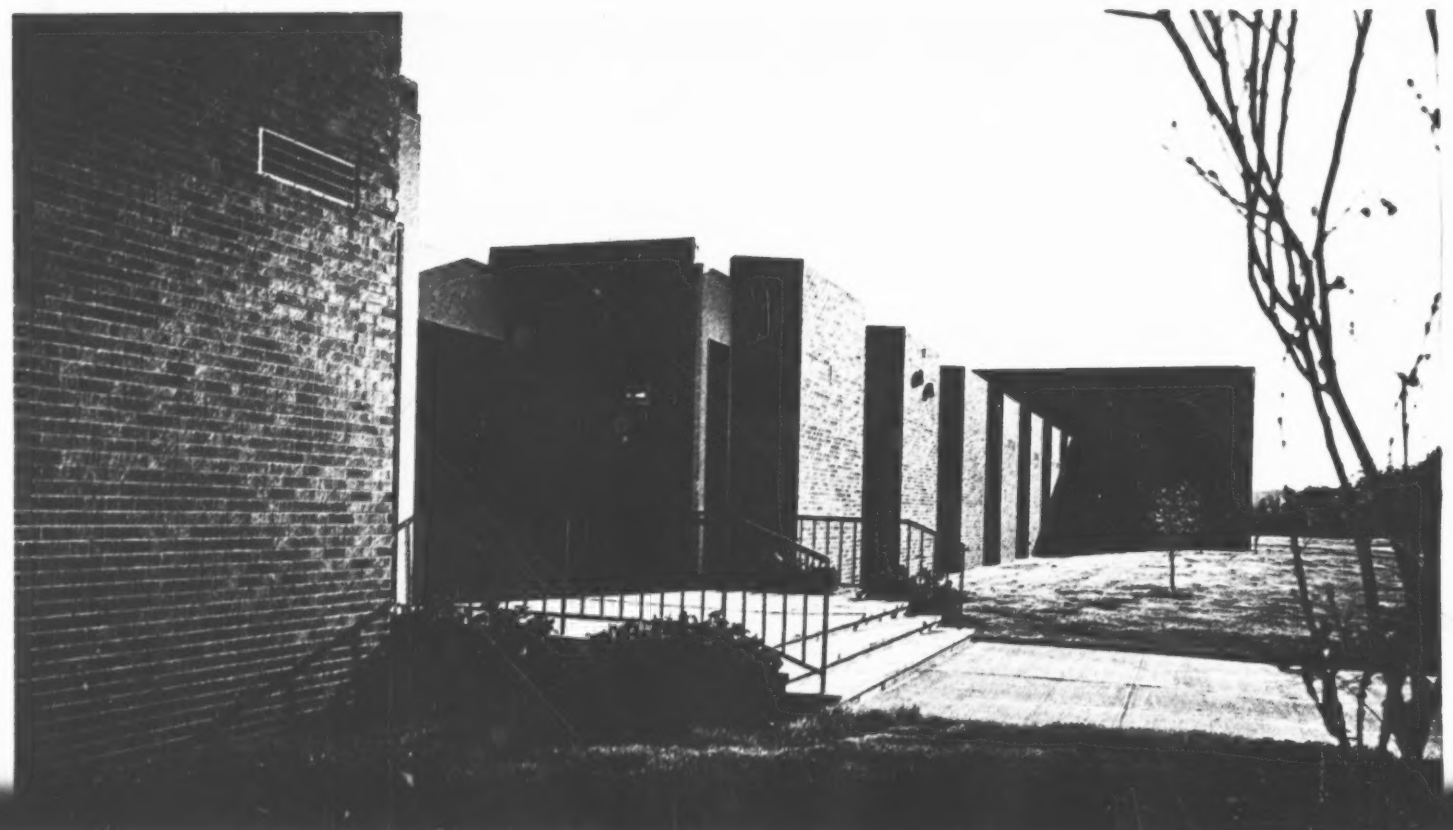
Shelter Analyst's Remarks

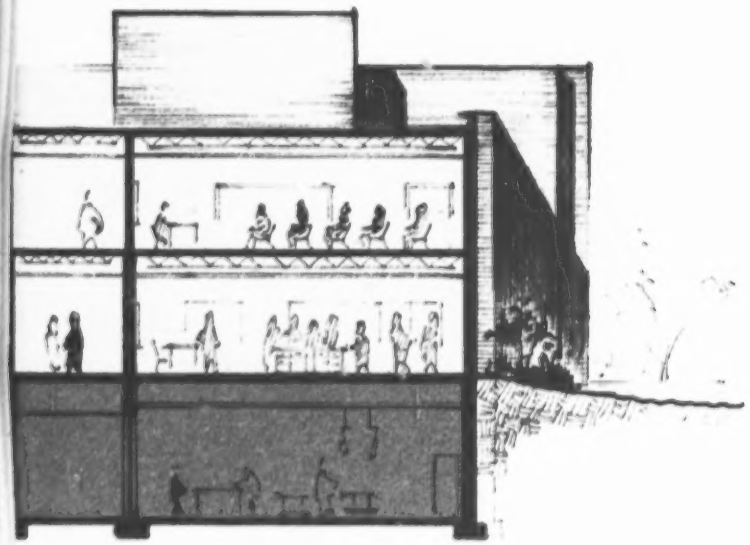
The reduction factors obtained resulted in a protection factor of 104. Adequate exits are provided, and a fire tower is located at one end. The structural design requirements to meet the clear span, floor to floor height, and live-loading capacity provided a system which furnished a very adequate shielding capability without employing any of the publicized slanting techniques for radiation protection.

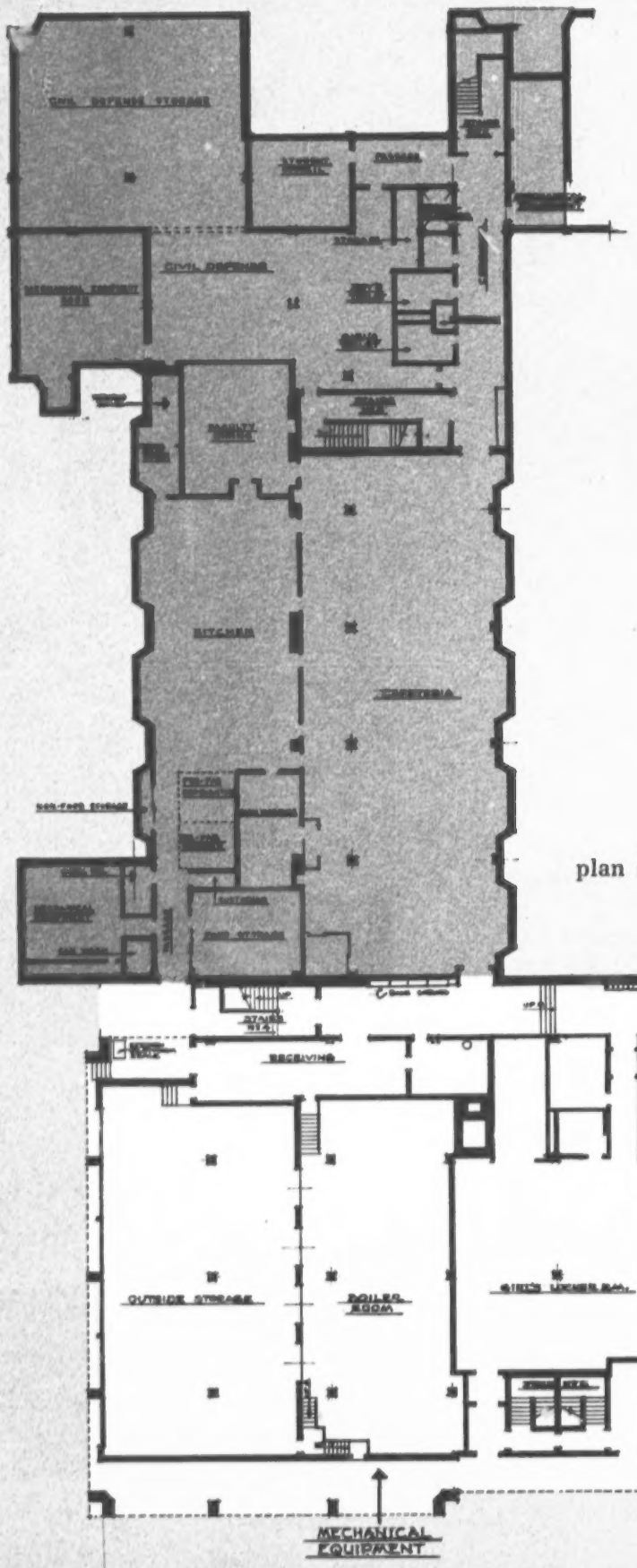
The mechanical equipment has been designed for conversion to meet the demands of a shelter situation. Increased air velocity is achieved by changing the setting on the variable-pitch motor sheaves. Units are provided with flame-resistant, medium-efficiency particulate filters in separate low-velocity air inlets arranged for service in emergency use only. This is an added feature not included in OCD standards. Manual changeover activates the emergency program control system to maintain a combined wet and dry bulb temperature which will not exceed 85° F effective temperature under maximum occupancy of the area. Exhaust can be accomplished through both exhaust fans and gravity relief flues. In addition to standard OCD water drums, a stand-by 2000-gallon water supply is provided from the hot water generator tank in the boiler room. Although not an OCD requirement a 35kw, 120/208 volt, three phase, diesel-electric, automatic



section thru cafeteria-shelter





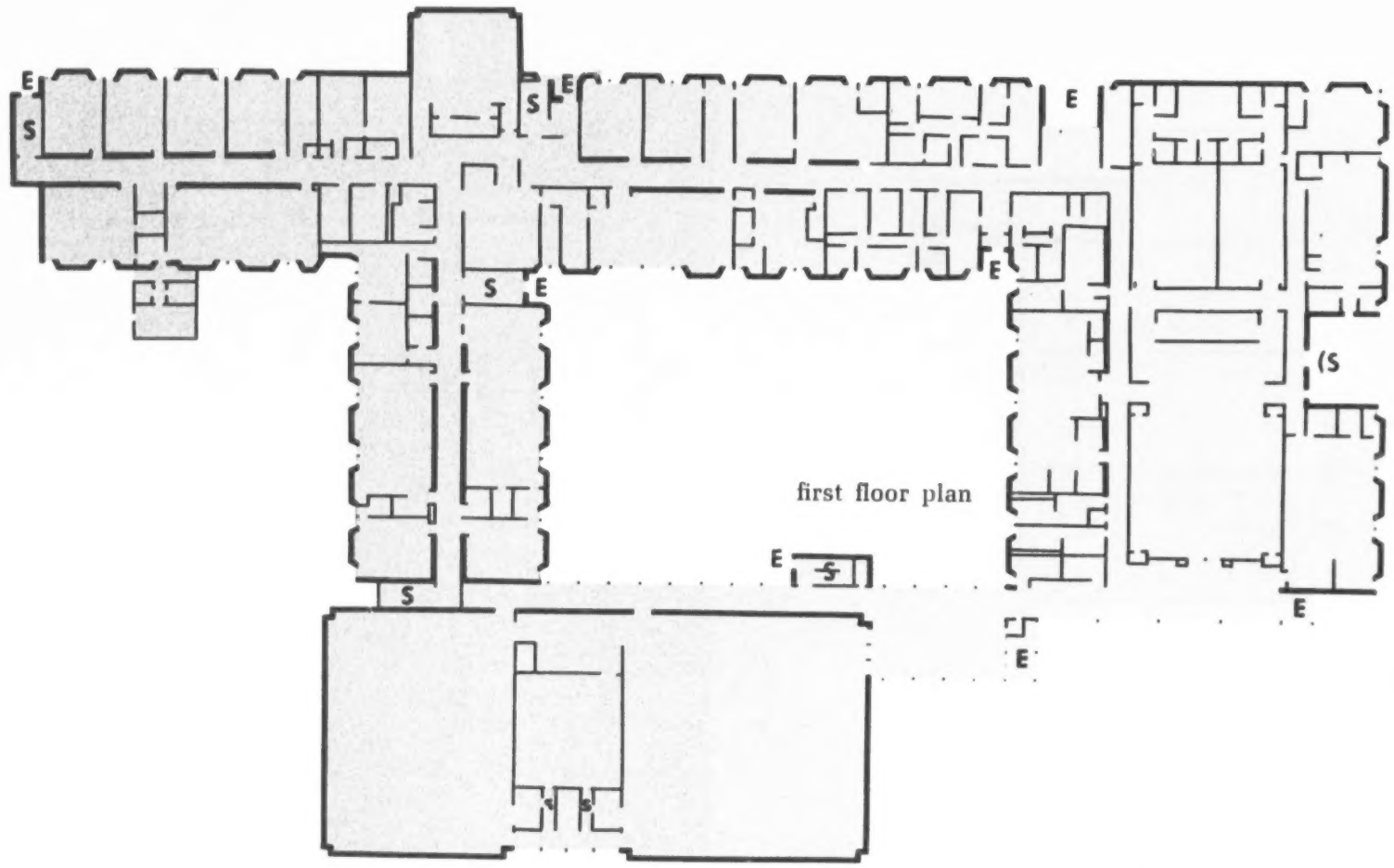


plan showing cafeteria-shelter areas

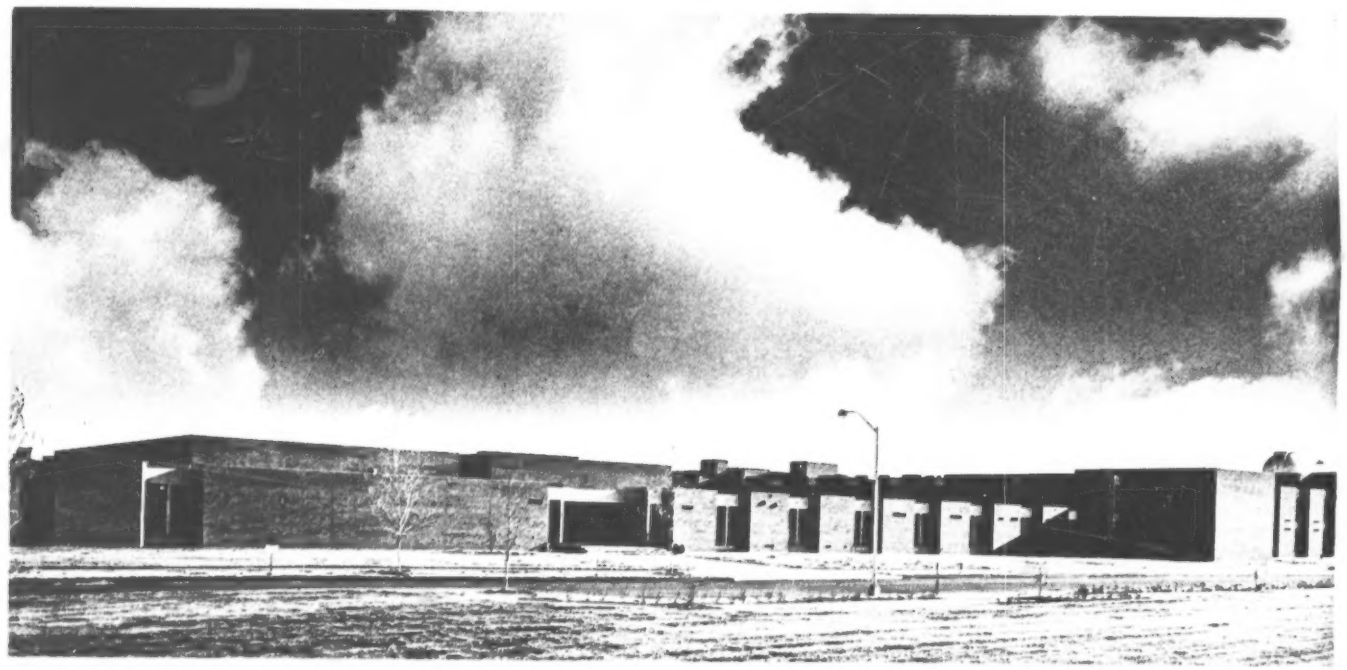
start, emergency generator has been provided for light and power in the shelter area. The 5000-gallon fuel storage tank for the domestic hot water generator also supplies the emergency generator.

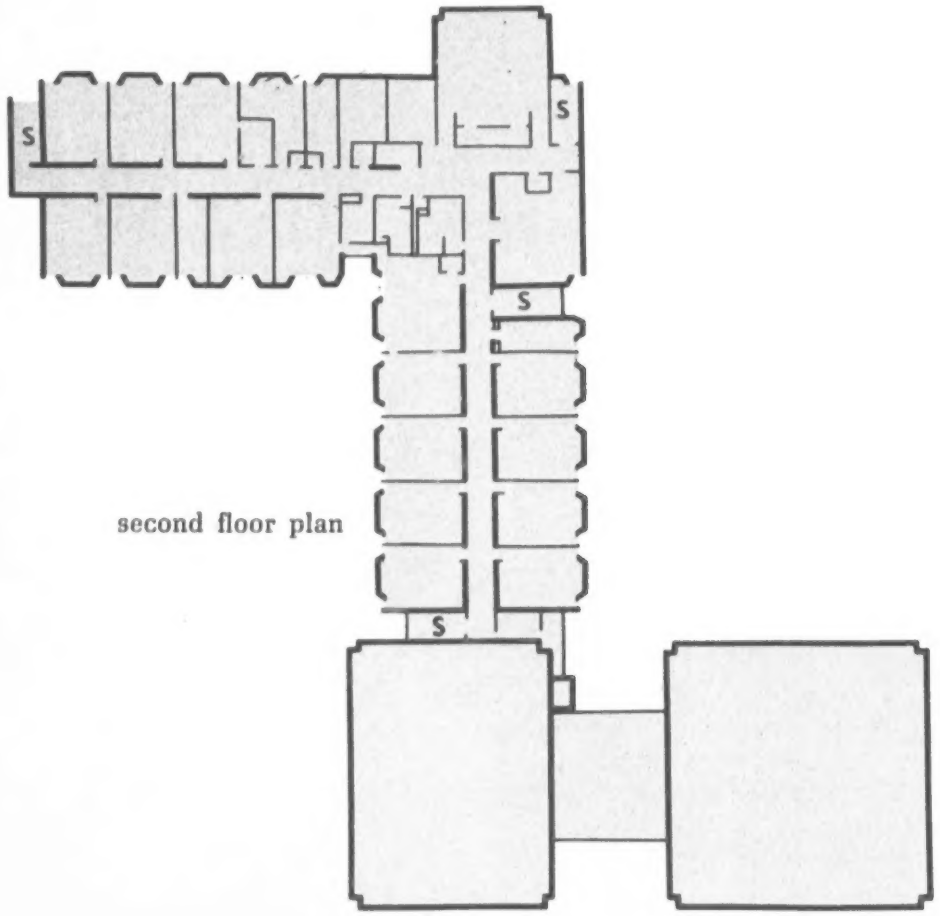
The integration of the needs of the shelter area with those of the school itself has materially reduced the additional cost of the facility.

Photographer: Lubitsh & Bungarz, Wilmington, Delaware

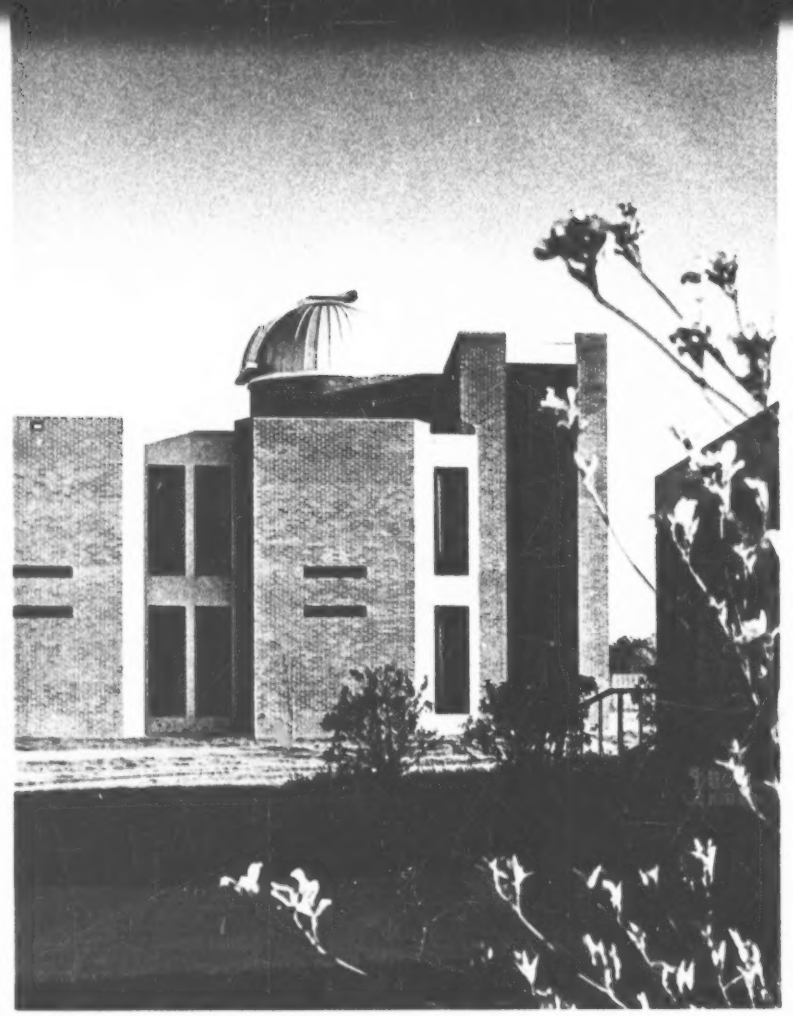


first floor plan





second floor plan



cafeteria-shelter

Award of Merit

Salerno Residence
Del Mar, California

Owner: Mr. and Mrs. Daniel N. Salerno
Del Mar, California

Architect: Daniel N. Salerno, AIA
San Diego, California

Fallout Shelter Analyst: Daniel P. Cole
San Diego, California

Jury Comment

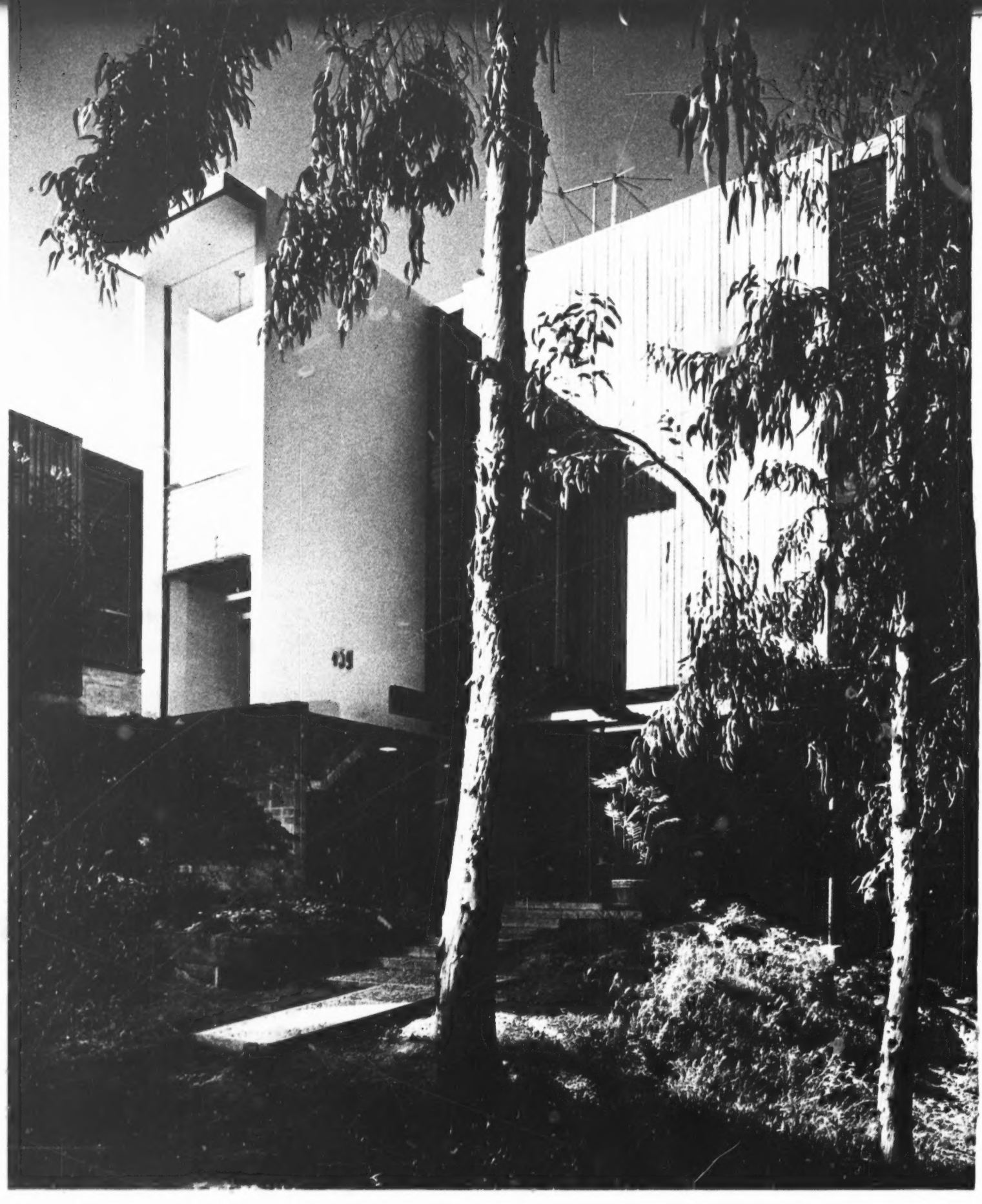
This home is expertly designed to take full advantage of its small sloping site. The plan opens to the view while providing maximum privacy on the street side. Careful detailing of building elements, clearly expressed structure, and landscape features give this house its distinctive character.

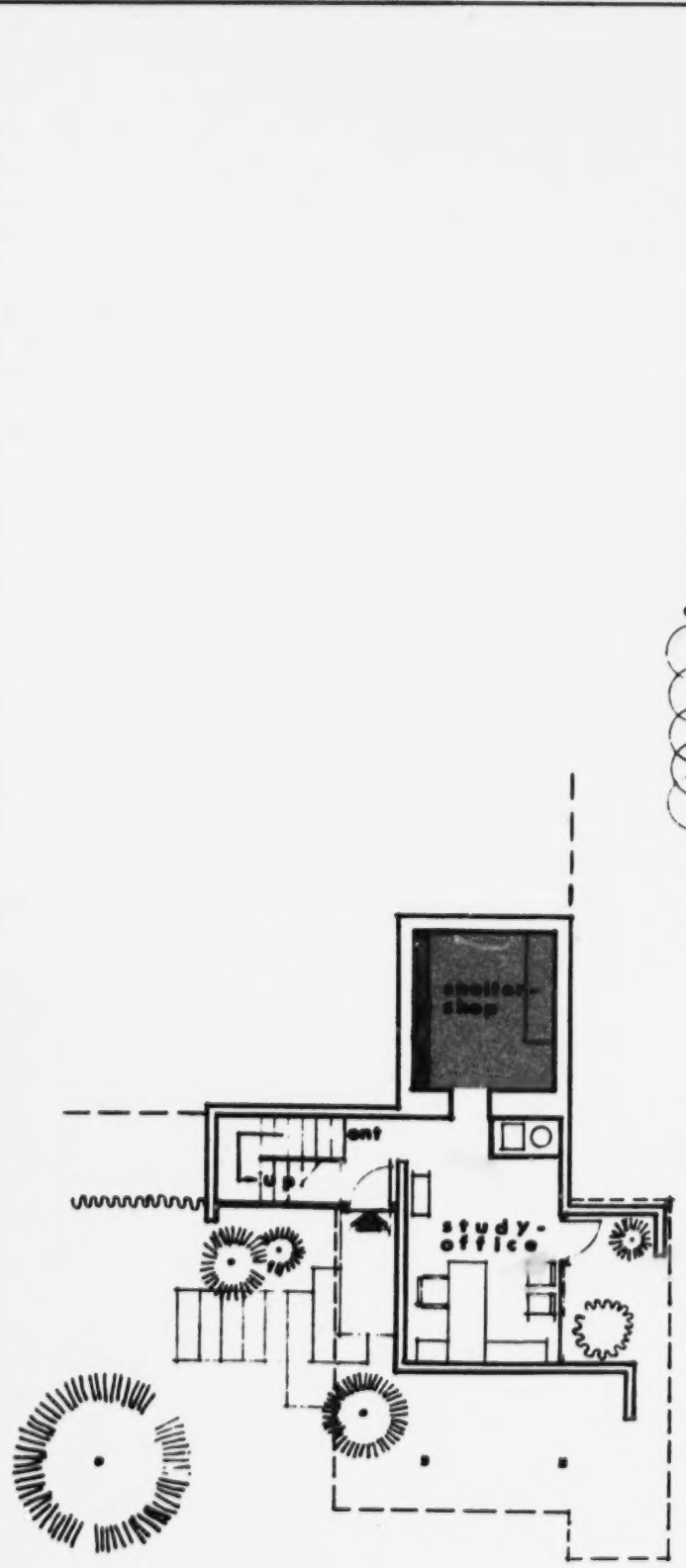
Architect's Statement

The residence is located on a small triangular hillside site which has a good view of the ocean. The lot has an alley access at the rear with a sharp 30-foot drop to the street. A small portion of the lot is level, adjacent to the alley, with the remainder being very steep.

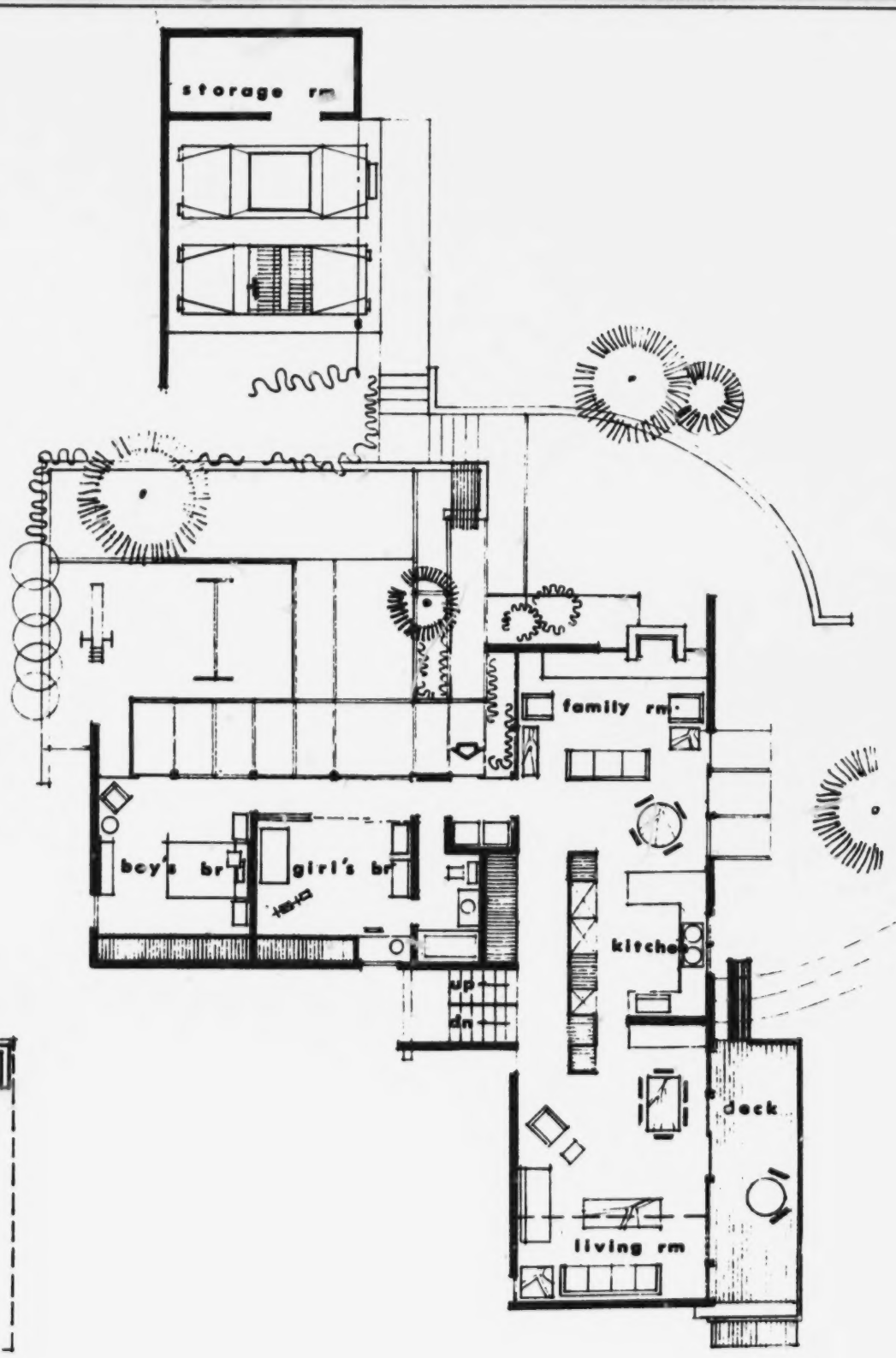
A three-level scheme was devised, conforming to the natural slope of the lot. The residence was located on the slope so that the valuable level area, at the top, could be utilized for a safe children's play yard and a carport access. The living areas, children's bedrooms, kitchen, etc., are located, for convenience, at the same level as the play yard. The master bedroom suite is located on the upper level. The formal entry, study and fallout shelter/shop are on the lower level. The three levels of the house are connected by means of a glassed-in central stair tower.

The shelter is located under and supporting the house with earth backfill on three sides of the shelter. The entrance side is concrete block, 2 feet thick, filled with grout. This side is further protected by baffle

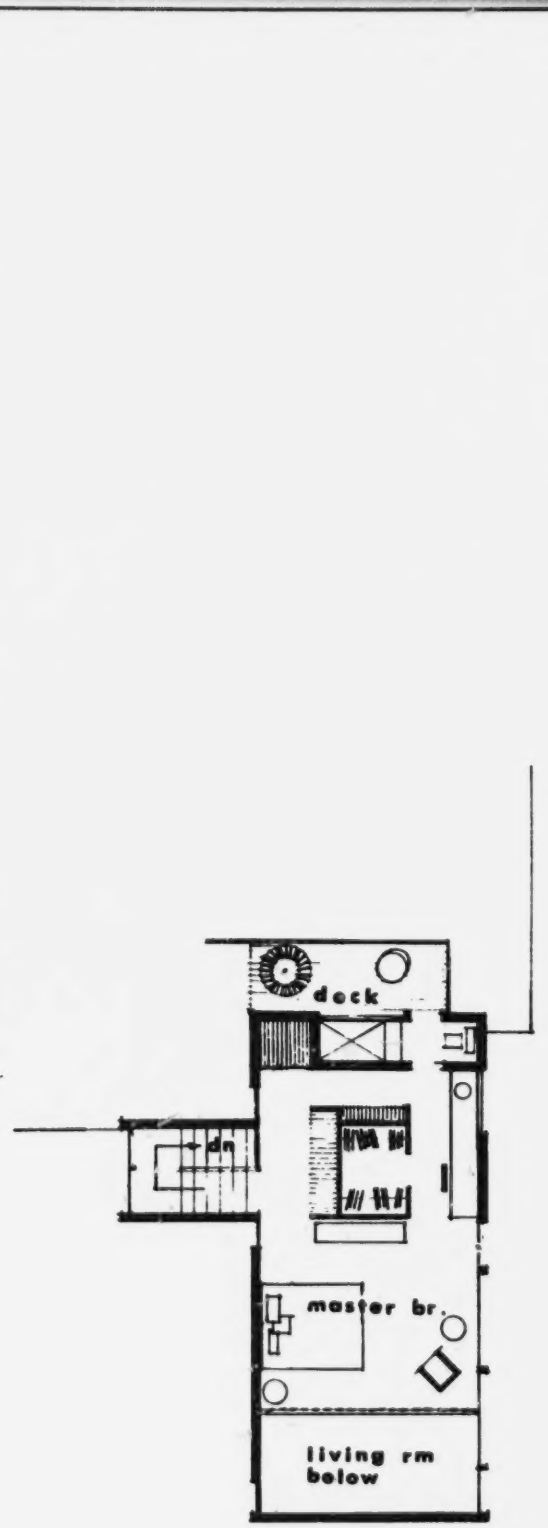




ground floor plan



first floor plan



second floor plan

2

masonry walls in the entry and study. A conventional door to the shelter was used to allow the space to be a workshop and storage area, also. Additional emergency protection can be provided by filling the doorway with bricks stored in the shelter.

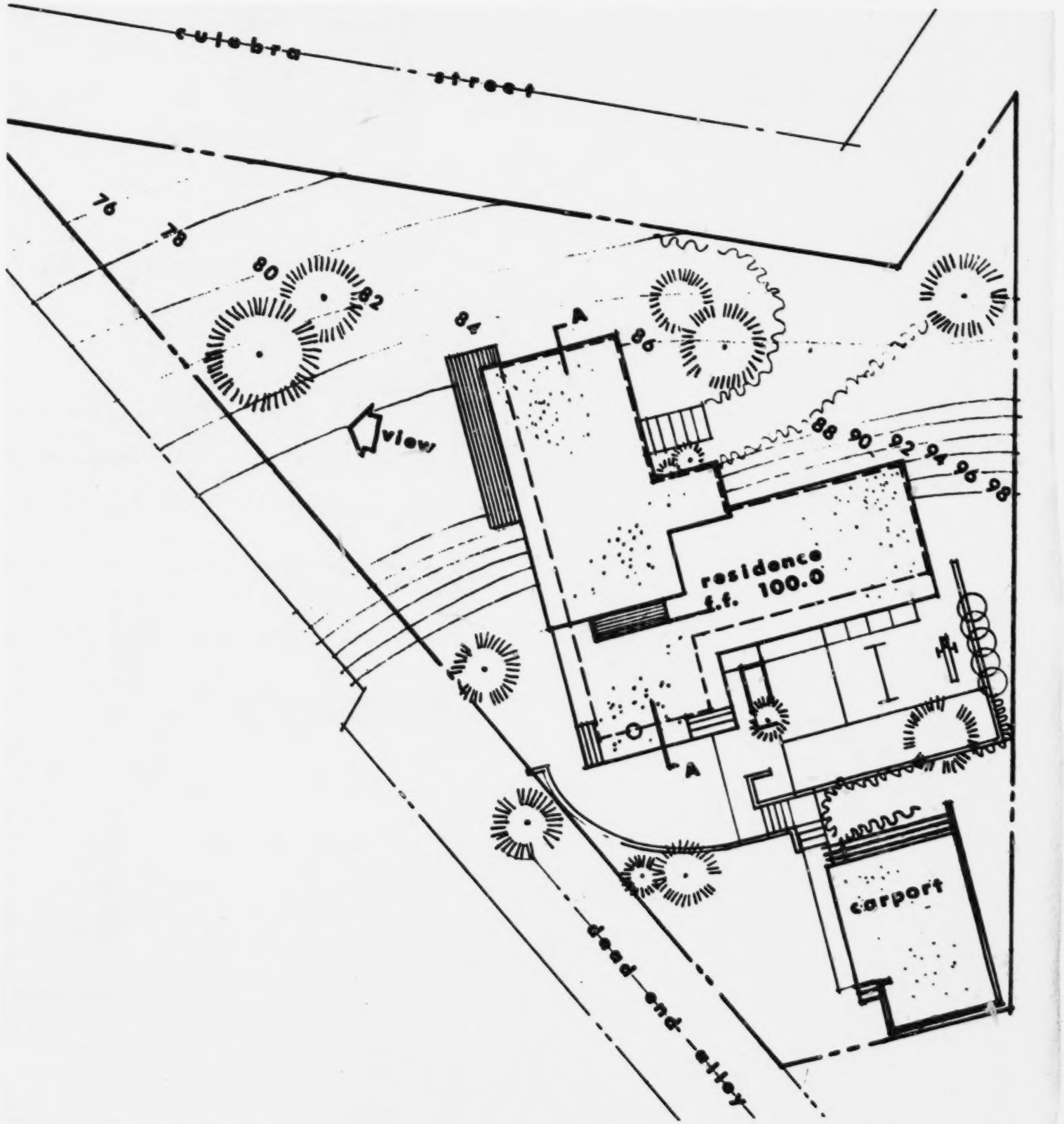
Ventilation is provided to the outside air through the walls. Emergency water to the shelter is provided by special piping to the hot water heater. The shelter cost approximately $500.00 additional and provides a very convenient shop/storage area which is its normal use.

Shelter Analyst's Remarks

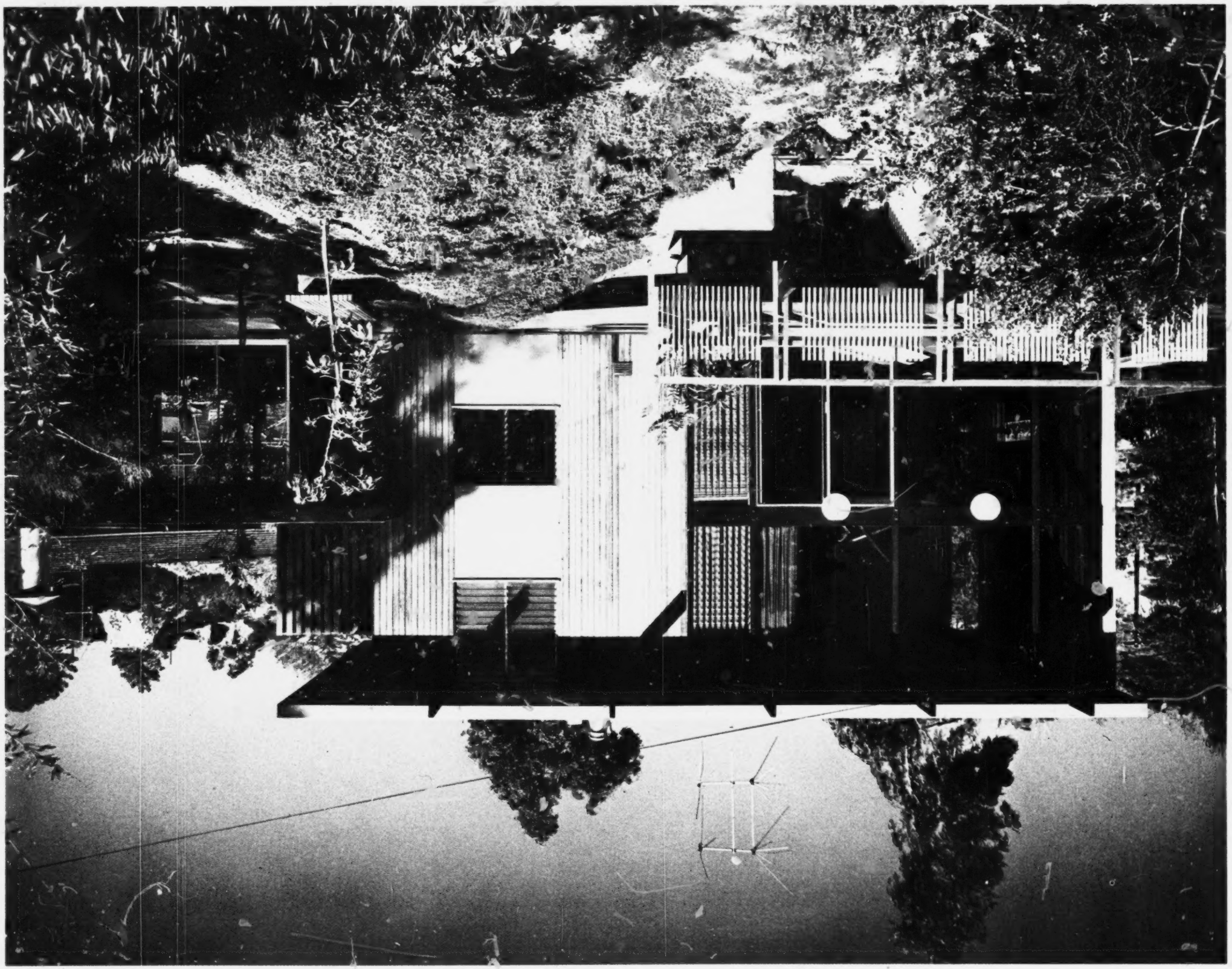
The Salerno residence shelter is protected on three sides by unexcavated earth; the ceiling and the front wall are the only exposed surfaces. The ceiling is constructed of 22 inches of reinforced concrete and the walls of grouted masonry units. A door in the exposed wall is the only opening. During a period of critical radiation, the doorway will be closed with loose bricks now stored within the room. Recessing the lower floor into the hillside is the principal reason the shelter has a high Protection Factor far beyond the OCD standard of 40.

Masonry walls and wood frame surfaces keep the radioactive fallout particles at some distance from the shelter, thereby reducing the amount of radiation reaching the shelter. The hillside-seacoast location of the residence tends to reduce the radiation received in the shelter due to rough terrain and mutual shielding by adjacent hills. Prevailing winds from the ocean also help to reduce the possibility of fallout since detonation of an enemy nuclear warhead in the ocean seems highly unlikely.

Photographer: Douglas M. Simmonds,
Los Angeles, California



site plan



Basic Terminology of Radiation Shielding

Some of the terms used in referring to protective control from fallout gamma radiation are defined briefly as follows:

Protection Factor (PF) expresses the relation between the amount of gamma radiation that would be received by an unprotected person compared to the amount that would be received by one in a shelter. For example, an occupant of a shelter with a PF of 40 would be exposed to a dose rate 1/40 (or 2½%) of the rate to which he would be exposed if his location were unprotected.

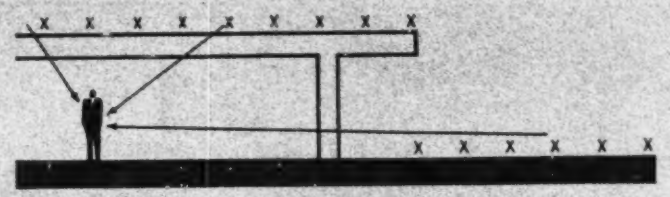
Gamma radiation reaches an individual in an enclosure from several sources: the *roof contribution* refers to radiation originating from radioative particles (dust and debris) which may accumulate on an overhead source plane; the *ground contribution* refers to all similar radiation from fallout originating from the ground source plane. The *ground contribution* is further subdivided into *ground direct, wall scatter, ceiling shine* and *skyshine.*

Basic Concepts of Radiation Shielding

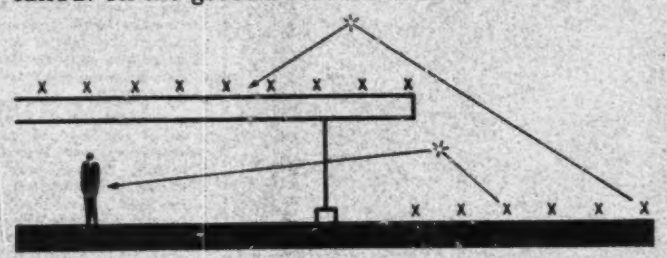
Shelters with high protection factors are achieved by the planning and control of geometric and barrier relationships between the radioactive source and sheltered enclosure. *Geometric shielding* places people out of the direct path of radiation or at some distance from it. *Barrier shielding* places mass between the shelter occupant and the radioactive source.

The sections to the right illustrate radiation types and sources.

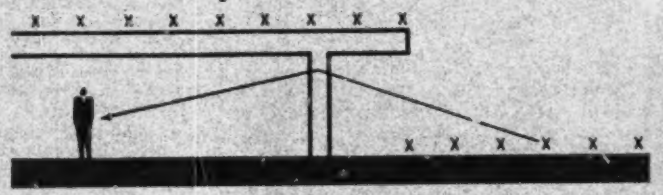
Examples of shielding techniques include reducing window area (particularly raising the sill height), partially depressing a building into the ground, or grading slope away from building to create an earth barrier, arranging retaining walls and planter boxes as barriers, utilizing screen walls at entrances to provide barrier baffles, arranging building elements to protect a core area and filling hollow masonry cavities with sand or gravel to increase the mass barrier.



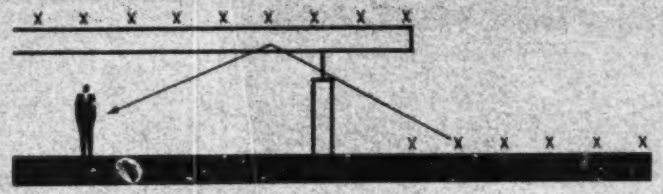
Roof Contribution and Ground Contribution-Direct
Most radiation will come directly from fallout on the ground and the roof.



Ground Contribution—Skyshine
Some radiation is scattered by molecular interaction with particles in the air.



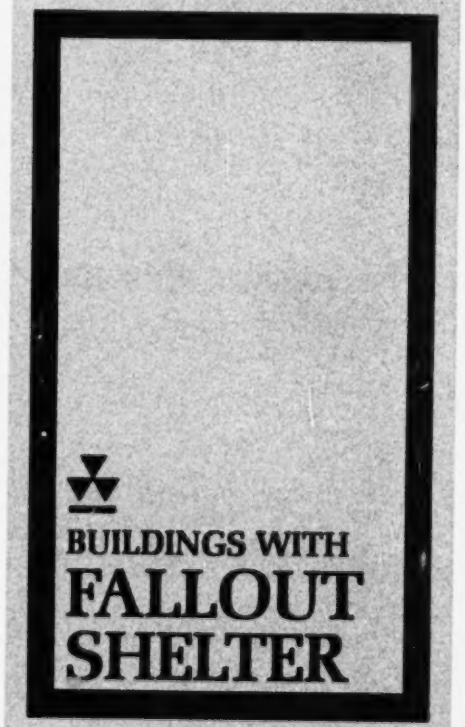
Ground Contribution—Wall Scatter
Some radiation interacts with particles in the wall and is deflected to the interior.



Ground Contribution—Ceiling Shine
Some radiation interacts with particles in the ceiling or other horizontal plane and is deflected.

Awards Program the following is a reprint of the awards program as it was issued during August, 1966

1966 AWARDS PROGRAM



A project of the Office of Civil Defense conducted by The American Institute of Architects

1
general

The national civil defense program has emphasized the development of public fallout shelters throughout the United States. The program for identifying, marking and stocking shelters in existing buildings continues to make an important contribution to the inventory of available shelter. However, if the national shelter goals are to be met economically, much of the additional shelter must be created in new construction as dual-use space.

The professional development programs of OCD brought an understanding of radiation protection to the architectural and engineering professions. Many designers have now learned that shelter can be easily developed without sacrifice of aesthetic or functional values, at little, if any, additional cost. This is especially true when shelter is designed as dual-use space and considered during the programming and preliminary planning processes. The results of three national architectural design competitions, conducted by The American Institute of Architects for the Office of Civil Defense, have provided clear illustrations of the essential nature of dual-use shelter space and have presented a variety of fresh design concepts which are now appearing in new construction.

An Awards program recognizing completed work incorporating dual-use shelter space as a program element could not have been undertaken had it not been for the OCD program for professional development and contributions to it by The American Institute of Architects and the engineering societies. Tribute must also be paid to the several hundred talented people who have participated in three important national design competitions.

2
objective

The objective of this 1966 Awards Program is to bring public recognition and honor to architects, engineers and owners responsible for the development of projects demonstrating architectural excellence and incorporating effective and economical dual-use shelter space.

3
eligibility

To be eligible for consideration as an entry in the Awards Program, a building must have been designed by a team including a registered architect and appropriate consulting engineers and substantially completed before October 1, 1966. It must have incorporated dual-purpose fallout shelter space meeting the OCD technical criteria stipulated in this program.

4
awards

The Jury is authorized to select up to 10 entries for awards, not more than five of which may be First Honor Awards and the balance Awards of Merit.

Awards Certificates will be presented to the building owner, to the architect, and to the fallout shelter analyst involved in the design of the selected project. A plaque suitable for mounting on the building will also be awarded.

OCD proposes to publish a booklet, for national distribution, presenting the award winning projects. The booklet will include drawings, renderings and photographs to illustrate architectural quality and details of the design and construction of the shelter space.

No cash awards will be made. However, since the value of the booklet as an educational medium will depend upon the clarity of drawings and the quality of other persentation and analytical material, each winner will be offered a lump sum architectural contract for preparation of suitable presentation material.

Since First Honor Awards will be illustrated in more complete detail than Awards of Merit, the architectural commissions will be offered in the following amounts.

$5,000.00 *For presentation and analytical materials relating to First Honor Awards*

$1,000.00 *For presentation materials relating to Awards of Merit*

5
categories of awards

All building types will be considered for awards. Entries will be judged under the several classifications listed herein, and awards may be made in any or all categories depending upon the quality of submissions.

Each entrant should specify in which of the following categories he wishes his entry to be judged.

Educational Buildings
Hospital and Health Facilities
Industrial Buildings
Military Construction
Office Buildings
Other Commercial Buildings
Public and Institutional
Religious Buildings
Residential

6
form of entry

In order to facilitate entry and to contribute to fairness and equality in judging, it is mandatory that each submission be contained in a single 8½" x 11" Ful-Vu Economy Binder, Type CB-10, containing 10 transparent Mika-film window sleeves for displaying up to 20 inserts back-to-back.

These binders will be sent to each architect or engineer who registers his intention to submit an entry by completing and mailing the attached registration form to the Professional Advisor.

7
entry fee

No entry fee is required.

For Distribution to:

OCD Regions and
Staff College

State CD Directors

Deans of Architecture

Deans of Engineering

Engineering Libraries of
Educational Institutions

Selected Major Libraries

U.S. GOVERNMENT PRINTING OFFICE : 1968 O—290-718

8
completeness of entry

a. photographs:

Each submission shall include at least two 8" x 10" photographs showing the important exposed sides of the building exterior. If the project includes a group of buildings, pictures must be included to show the relationship of the buildings making up the entire complex as well as the principal building containing shelter.

At least one 8" x 10" photograph showing the interior of the dual-purpose shelter space shall be included.

Supplemental analytical or technical data and additional presentation material may be submitted as desired, providing the total of twenty inserts in the specified binder is not exceeded.

Photographs may be in black and white or in color, glossy finish. It is emphasized that the objective is to evaluate the buildings, not the photographer's skill.

b. drawings:

Site plan, floor plan or plans and one or more sections as necessary to explain the design solution shall be submitted. Drawings must be at scale but may be drawn or reproduced in any medium. Scale should be as large as practicable. Scales must be indicated.

All plans and drawings shall be on 8½" x 11" sheets slipped into the transparent window sleeves. Plans on larger sheets or folded plans will be discarded for judgment.

c. descriptive material:

A single sheet describing the fallout shelter and indicating the Protection Factor (PF) developed and stating the maximum shelter occupancy shall be included as one exhibit. This information may be incorporated on a drawing or on a separate 8½" x 11" sheet placed in one of the transparent window sleeves. A general description of the project may be included on this sheet at the option of the entrant.

9
technical criteria

Shelters shall have a Protection Factor (PF) of 40 or more and in all respects shall meet or exceed "Technical Requirements for Fallout Shelters", TM61-3 (Revised) March 1965, of the Office of Civil Defense.

10
publication rights and ownership of entries

It is essential that drawings and photographs and all other materials submitted in connection with any entry not be restricted against publication. It is the entrant's responsibility to make sure that all drawings and photographs are cleared for release by The American Institute of Architects or the Office of Civil Defense. Neither the government or the Institute will assume responsibility for copyrights or photographic fees.

All drawings, photographs and other materials submitted with entries will become the property of the Office of Civil Defense, provided however, that all entries not selected for award may be used only for publicity or educational purposes. There is no obligation to return any material submitted.

The architects, engineers and owners concerned will be identified in connection with publication of any entry by either the Government or AIA.

The photographer's credit line will be given when requested on any photograph.

11
the jury and judging

A Jury, comprising three architects and two professional engineers, will be appointed. This Jury will have full and final power in the selection of entries for awards. The Jury will judge each entry on the quality of the total design, including excellence in planning, functional and aesthetic considerations and on suitability and adequacy of the fallout shelter as well as the validity of the design for dual-purpose space.

12
anonymity

The submissions shall bear no mark or name that could serve to identify the entrant. All identification must be removed from the material prior to entry.

An unmarked opaque sealed envelope shall be taped or glued to the back cover of the entry binder. This envelope shall contain the name and address of the building owner, the architect, the engineer, and the shelter analyst involved.

13
time schedule

Entries must be postmarked not later than November 1, 1966. Judging will take place during November, and notification to award winners made by December 5, 1966.

14
mailing of entries

All entries shall be mailed to:

A. Stanley McGaughan, FAIA
Professional Advisor
1341 New Hampshire Avenue, N.W.
Washington, D. C. 20036